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Handing on the Torch

Selection and Training of Engineers

AN engineer is, by definition, one who puts his knowledge to practical social use, and even though the meaning of "practical" may be interpreted in the broadest possible sense, the goal is essentially utilitarian. That is a fundamental principle to be taken into account when considering the training of engineers. The questions at the back of the minds of many who went to the Institution of Electrical Engineers last week to listen to the delivery of the inaugural address of Dr. A. P. M. Fleming, the new President, might be stated as: How can the young electrical engineer most readily assimilate as much as he is able from the vast body of accumulated knowledge, and how is he to make the most efficient use of what he has learned?

It was gratifying to hear that the long experience of Dr. Fleming in training entrants into the industry (and the subject is evidently so much of his life that he was able to speak for an hour on it without glancing at a note) has proved to him that, necessary as scientific knowledge is, personal qualities are those that bring success. They are, indeed, just as much a predominant influence as they were upwards of half a century ago, when electrical engineers laboured to build the foundations of our great calling without the aid of the intellectual tools provided by more systematic training to-day.

Effective Use

The "personnel problem" was stated by the President as "primarily that of selecting, educating, training and effectively using workers." If we lay most emphasis on the fourth, it is because it is the end to which the others lead. Bound up with this, we believe, is the fact that the electrical profession in Great Britain (though not in all countries) is truly democratic. A youth of ability, no matter what his early education, can aspire to the highest position that he is capable of filling. All talents are wanted, and full scope can be given to characteristics that we like to regard as typically British.

Utilitarian considerations of the broadest kind require the electrical engineer to have contacts with life in all its aspects, scientific and social. How much, on the one hand, does he not owe to physicists, chemists, and metallurgists and, on the other, to those aspects of economics and rule-of-thumb psychology that are involved in successfully dealing with the public which uses the results of his work?

It is sometimes deplored that the time taken up in mastering a few special subjects causes engineers to work in water-tight compartments, ignorant of what other men, even in their own profession, are doing. This difficulty is probably not as great as is often supposed, since a sound scheme of training, such as that developed by Dr. Fleming, would give him in his youth a bird's-eye view of engineering. He can also keep himself abreast of events by reading the technical journals of his own and allied industries, and it is a major function of these to help him to relate his own corner of the engineering world to the sum of its activities. Always, however, there must be a solid technical background. The last people to be encouraged in our profession are "bluffers with the gift of the gab."

Control and Initiative

As the electrical industry has evolved from small beginnings, so the problems associated with the human element have become more complex. The need for working together in larger workshop units, which the cost of more elaborate and heavier plant has made inevitable, introduces questions of the compromise that can be made between a more or less centralised control and the preservation of initiative and enterprise—those human qualities, immensely good in themselves, upon which our industry has been built up.

Recently this subject, always in the offing, has assumed more serious dimensions in view of international competition and of the speedier action apparently achieved in countries where a more rigid organisation imposed from above is preferred to intelligent voluntary co-operation. To meet this, as Dr. Fleming implies, is likely to be an increasingly important factor in education, involving as it does not only the training of leaders who will merit and receive the confidence of those whom they direct, but also demonstrating that the team spirit creates the most efficient method of collective working.

From what we know of students of the I.E.E. we feel convinced that the material is there. We know also that many of the older generation will not feel that their pioneering work has been finished until they have done all that they can to give opportunities to their successors to equip themselves to meet the changing conditions.

The E.D.A. Films

THOSE who remember the first attempt at film making by the British Electrical Development Association will agree, upon seeing the new film programme, that E.D.A. has learned a great deal in the intervening four years. The first one shown last Monday evening—"News by Wire"—might easily be accepted for inclusion in the programme of the ordinary cinema. It is a very satisfying survey of the whole electrical field in a remarkably small compass. The second film—"The Proof of the Pudding"—is a sales film pure and simple and although it inclines to the over-serious it is most effective. A comedy of the modern man suddenly thrown back to the 18th century (period uncertain) is a satire upon those who yearn after "The Good Old Days." The introduction of "I'm Electric" is cleverly done although the little man's voice is, perhaps, too big for his body. The three "supporting" pictures are good entertainment and no supply authority need hesitate about booking the films at the low charges which E.D.A. is making for them.

Industrial Generation

THE inclusion in the Commissioners' latest annual report (reviewed in this issue) of particulars relating to the generation of electricity by industrial plants provides a convenient way of arriving at the total amount of electricity produced in Great Britain. The figures given in the official statistics as the output of the supply undertakings' stations during 1935 have to be increased by some 38 per cent. for industrial generation, to which must be added another 7½ per cent. for traction stations. The tendency for purchased power to outstrip independent generation (even the collieries show an increasing preference for the former) is indicated by a comparison with corresponding figures for 1930, as during the five years the contribution of purchased power increased from 48.7 to 52.7 per cent., and in view of the large power loads secured to public supply lately with the aid of the Central Electricity Board the relative position of public supply should have further improved. Much of the increase in industrial generation has no doubt been due to changing over drives from steam and other prime movers to electricity and the real progress in electrification in the five years may be seen by reference to an increase in output by supply undertakings of 61 per cent., by traction stations of 5 per cent. and by industrial plants of 19 per cent., giving an overall increase of 44 per cent. The more detailed figures given in the Report show how much scope there is for supply undertakings as existing power plant becomes obsolete.

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Electricity Prices

WE are taken to task in this issue by a correspondent who questions the accuracy of figures which we gave in our Special Domestic Issue relating to electricity charges. Those figures were worked out by the Electrical Development Association and we have no reason to doubt their reliability. We certainly must admit that we left it to our readers to judge that we referred to the running charges of domestic two-part tariffs when we mentioned prices of from ½d. to 1d. per kWh. But, after all, as we have often pointed out, the fixed charge represents a reasonable payment for the average lighting consumption and therefore all further use is virtually at the low running rate. Our correspondent complains that he cannot get his electricity as cheaply as we suggest, but his lighting charges appear to be very reasonable. In Salford the power and heating charges are on a sliding scale and the figures which he gives are for the initial step. Our latest information is that the power charges fall from 2¼d. to 0.6d. and the heating rate from 1½d. to 0.8d.

The I.M.E.A. Convention

WHEN it was announced that next year's convention of the Incorporated Municipal Electrical Association was to be held at Llandudno it was indicated that owing to the lack of suitable accommodation it would not be possible to organise the customary exhibition. Now that the venue has been changed to Harrogate, apparently through lack of accommodation for the delegates themselves, the question of the exhibition is again raised. There was little open protest against the decision to suspend the show for a year but there is still a strong feeling that the exhibition serves a good purpose and should the Association decide to hold it after all it should receive a considerable volume of support.

Public v. Private Supply

ON Tuesday last the respective merits and drawbacks of electricity supply by private companies and public authorities was debated "over the air." The champions of the companies were Mr. George Balfour, M.P., who has had extensive experience in this kind of argument, and Lord Meston. On the other side were Mr. George Dallas, chairman of the Labour Party, Councillor A. Boddington, chairman of the Croydon Electricity Committee and Mr. Morgan Phillips, a former member of the committee of one of the largest municipal undertakings. Statistics were freely used by both parties and, generally speaking, honours were even. The chairman, Sir Clement Hindley, summed up the debate admirably when he said that nobody could be content with the present position and that haphazard boundaries of supply would have to be abolished. He agreed that small inefficient undertakings would have to be merged in more able bodies and that all authorities should be compelled to institute reasonable two-part tariffs for charging domestic consumers. He endorsed the view expressed by the McGowan Committee that public ownership was bound to come eventually but said that legislation must not be too far ahead of public opinion. The consumer always had the last word.

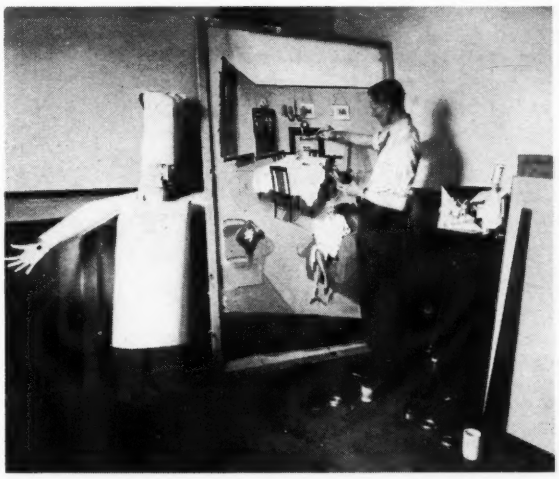
Thermostat Markings

THERE seems to be no reason at all why the variety of markings employed on gas cooker controls should be followed by the electrical industry. They lead to the confusion of the user which is quite likely to retard progress. It was therefore wise of the E.D.A. Cooking Committee to consider the matter while the thermostatic control of electric cookers is still in its early stages and make recommendations for a standard form of marking. The compromise which it put forward should meet with general acceptance as being simple and understandable. The matter is dealt with on another page of this issue but we may say here that it retains the large "position" figures with two small noughts added to show that they represent hundreds of degrees Fahrenheit, at the same time showing, if desired, the "zones" of heat—slow, moderate, etc., which some cookery books employ. It is to be hoped that manufacturers will conform to the recommendations, but meanwhile existing dials can be issued without doing much harm.

Load Development in Fulham

Methods adopted in organising the commercial side of an electricity undertaking

ANY electricity undertaking that is going to achieve any real success must realise that the sale of its product is of equal importance to the technical and engineering side of its work in that the staff and organisation required must be chosen for its specialised knowledge, just as carefully as is invariably done when technical appointments are under consideration. True, a guiding hand on the publicity work is required from the general manager or the chief engineer on matters of policy, in order that the plant and the distribution system may be used to the maximum advantage, but this is merely like any commercial undertaking where the sales policy is settled by the directors. There are still many instances where this principle is not adopted, so that it is of particular interest to note the general procedure and organisation which exists for load building at Fulham, where there is a distinct line of demarcation between the technical and commercial sides.



[*Elec. Rev. photo.*

The Electricity Department's publicity artist at work

Once each year a conference is held between Mr. W. C. Parker, the chief engineer, and the selling staff to determine the selling policy. A programme is then prepared showing the particular application of electricity to be dealt with in various seasons of the year. The relative importance of each particular division is decided upon and consequently the allocation of money to be spent on each division for publicity and sales. For example, this year it was decided that refrigeration was worthy of special effort, and for this reason four months were given over to it. Every form of publicity is considered and definite allocations are made and dates fixed for poster work, direct mailing, sales follow-up, window displays, showroom displays, demonstrations, special offers, &c. This programme is handed over to the selling organisation to prepare details and put the scheme into operation. The selling organisation at Fulham starts with the showrooms and the showroom staff and demonstrators in the charge of the showroom manager. The latter official also has under his control all sales representatives on the domestic side and he is responsible for all sales records. The sales representatives, in addition to being specially trained men, are also equipped technically to be able to give advice and make quotations on all ordinary domestic installations, so that they may have the fullest opportunity of clinching their sales on the spot.

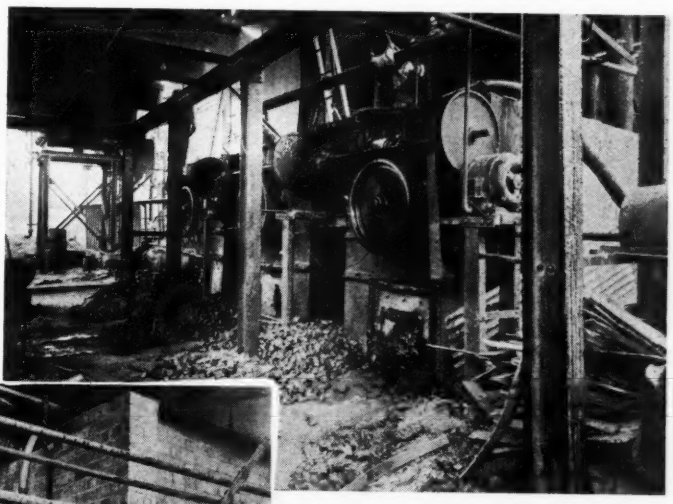
Associated with this phase of activities is the publicity department under the control of a publicity superintendent, whose sole duty is publicity and who is a trained and competent commercial artist. He is responsible for all window dressing, all showroom displays, all brochures, leaflets and direct mailing. The department is provided with an up-to-date equipment for this work, including machines for making cut-outs and a printing press.

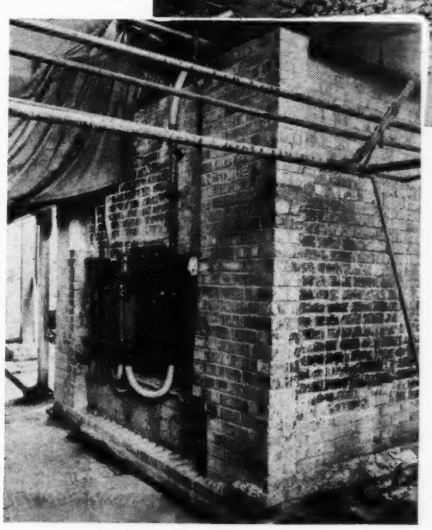
Distinct from this selling organisation is the contracts department, which deals with all orders received for wiring, installation of apparatus, &c., on the domestic side. It has its own supervising contract engineer, assistant contract engineers and wiring staff. It has its own estimating section and all estimates are checked in the statistics department against the actual cost of the work. To deal with all industrial business and work in connection with new blocks of flats, shops and public building installations a separate sales and contracts department has its own sales force, with a contract and sales engineer, contract engineer and wiring staff.

It was realised that the applications of electricity were so varied that it was impossible for an electricity undertaking to be fully conversant with all subjects. It was further found that in a number of subjects the application of electricity was relatively new and that it was necessary to make very thorough investigations with specialists on the subject before being committed to any programme.

One example of this was the problem of providing drying rooms for tenants of Council flats. The electricity undertaking was asked to submit a tender, in competition with gas and coal, for the necessary heating. An experimental drying room was erected and, as a result of tests carried out, in the electric drying rooms now installed the cost of providing heat is shown in actual use over a year to be highly competitive with gas or coal at the standard tariff. The principles which chiefly achieved this result were the introduction of reheaters, recirculation of the air and the placing of clothes within properly designed chambers to ensure a maximum flow of air in immediate contact with the clothes to be dried. Five rooms have been thus equipped.

Thermal storage heating is another subject which has had close attention with the object of extending the use of electricity to as many subjects as possible, and ultimately flattening out the load curve. The 12,000-kW system at Earls Court and the installation at the new Maternity Home and Clinic have been described in other issues. Both loads are entirely off-peak and in the latter building the system caters for all hot water as well as heating, the plant consisting of three 200-kW low-voltage electrode boilers, two 8,000-gal. storage cylinders and two 1,620-





A 20-ton electrically heated bitumen tank which has replaced four coal-fired tanks (two of which are shown above) at the Neuchatel Asphalte Co.'s works

[*Elec. Rev. photos.*

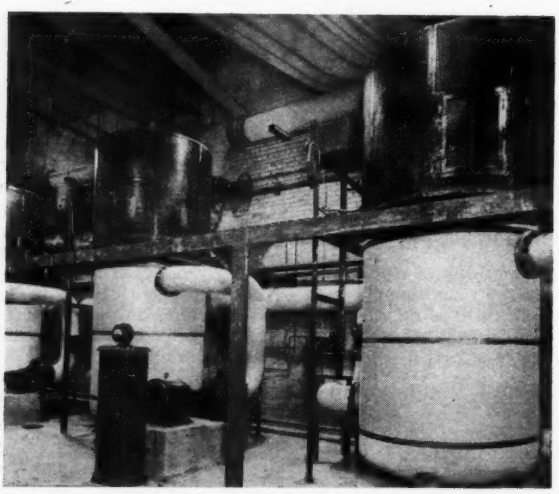
gal. domestic hot-water cylinders, the last being heated on a calorifier system through the thermal storage plant. Incidentally, it is interesting to note that the whole of the services in the hospital are electrical and include cooking, dish-washing, refrigeration, artificial sunlight, &c.

An example of a similar off-peak load, but not thermal storage, used in various industrial purposes, is the heating of bitumen tanks, which have replaced coal-fired tanks. The photographs on page 603 speak for themselves with regard to the saving in space, maintenance and labour. Each of the 20-ton tanks takes 75 kW and replaces four coal-fired boilers. The load taken at night has the advantage of being regular throughout the year, unlike that of the heating of buildings, which is only seasonal. The heat stored in these tanks during the night is sufficient for the tanks to be worked the whole day without any further heat.

Effect on Load Curve

The effect on the load curve of developing these off-peak loads has already shown itself very considerably in the load factor of the undertaking, which in six years has improved from 31.65 per cent. to 35.61 per cent., the annual sales of electricity increasing in the same period from 25 million kWh in 1931-32 to nearly 49 million kWh in 1937-38.

Apart from these particular developments mentioned, the normal load development is being pursued actively as will be realised from the various photographs accompanying this article and the fact that the Fulham undertaking in the last five years has practically doubled its output.



These three electrode boilers for the thermal storage heating of Earls Court exhibition buildings together provide an off-peak load of 12,000 kW [*Elec. Rev. photo.*

Several schools have recently been converted from gas to electricity, and a number more will be added to the mains this year. Not only is electricity being adopted for lighting, but also in many cases for heating. At Eelbrook Common playground lighting alone takes 8 kW. Electric cookers, too, are being installed for instructional purposes at schools having domestic science centres. Altogether, the electrification of these schools will mean an additional consumption of over 140,000 kWh a year.

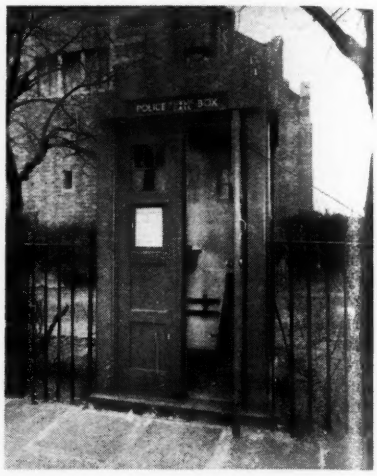
Factory owners generally have been encouraged by favourable rates to make the utmost use of electricity, and in the last five years the connected load has increased from 12,275 to 16,000 kW, the number of factory consumers rising from 193 to 249. Recently the Distillers' Co., Ltd., has added further electrical plant totalling 660 h.p. at its works in Fulham Palace Road, while the Consolidated Pneumatic Tool Co., Ltd., has just taken over a new factory which will have nearly 200 h.p. of electrically driven machinery, as well as about 100 kW of heating and lighting.

Assisted shop-window lighting is a further project contemplated. At present the total connected shop load is about 9,000 kW, some 2,000 kW more than five years ago. Floodlighting is being encouraged by providing equipment free for use on several of the public buildings.

In February last year all the main road street lighting was changed over from arc lamps to "Osira" electric discharge lamps at a cost of £12,000. Mr. Parker does not think that discharge lighting is applicable to side streets on an economic basis.

Encouraging Domestic Consumption

On the domestic side the number of consumers has grown during the past five years from 22,635 to nearly 37,000, the annual consumption under the all-in tariff alone rising from 707,195 to 4,365,840 kWh. Great strides have been made with electric cookers, the number installed (over 5,000) having increased fourfold in the past five years, and plans are now in hand to accelerate the addition of new cooking consumers to 2,000 per annum.



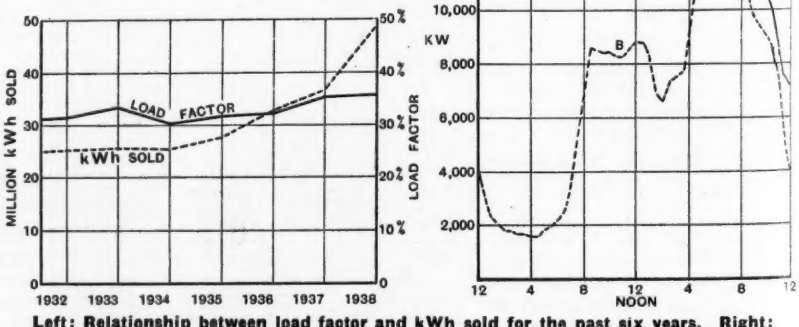
The heating of police boxes by 250-W tubular heaters is a recent successful experiment which will probably be extended to other boroughs

Flat dwellers are especially electrically minded, and there are many blocks of flats completely electrified. Over a million kWh a year is expected to be consumed by the 155 all-electric flats and maisonettes comprising West Kensington Court, while a further useful load will result from the recent conversion of 198 flats at the Lewis Trust buildings in Lisgar Terrace from gas to electricity for lighting, and probably for a considerable amount of cooking, &c., besides. When new blocks of flats are opened electrical exhibitions are arranged, as they are, whenever possible, at all public functions. Efforts are also being made to get a water heater installed in every house with a cooker, and so far somewhere over 2,000 have been connected.

Progress, especially on the domestic side, is likely to be further stimulated by the rebuilding of the showrooms to be undertaken shortly. Promised further reductions and simplification of tariffs will also help matters.

A relatively small development, which may, however, benefit undertakings all over the country, is the experimental heating of police boxes by means of 250-W tubular heaters. The Metropolitan Police is very satisfied with the results, and the extension of the idea elsewhere is already being considered. The installation of 15-gal. automatically operated water heaters in public conveniences is another new departure. They are on circuit only during off-peak periods, and are directly coupled to spring-loaded taps on the wash-basins.

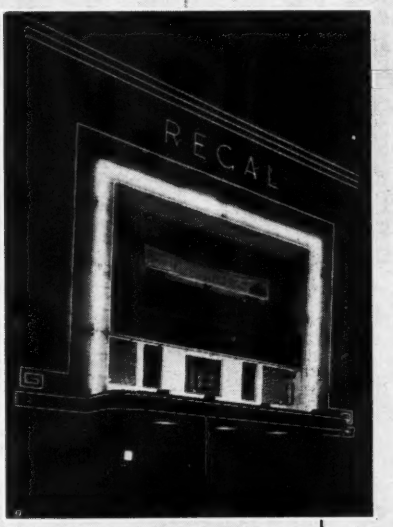
We have to thank Mr. Parker and his staff, in particular Mr. P. B. Malone, chief consumers' clerk and progress officer, and Mr. A. V. Mathias, contract and sales superintendent, for their assistance in preparing this article and securing the illustrations.



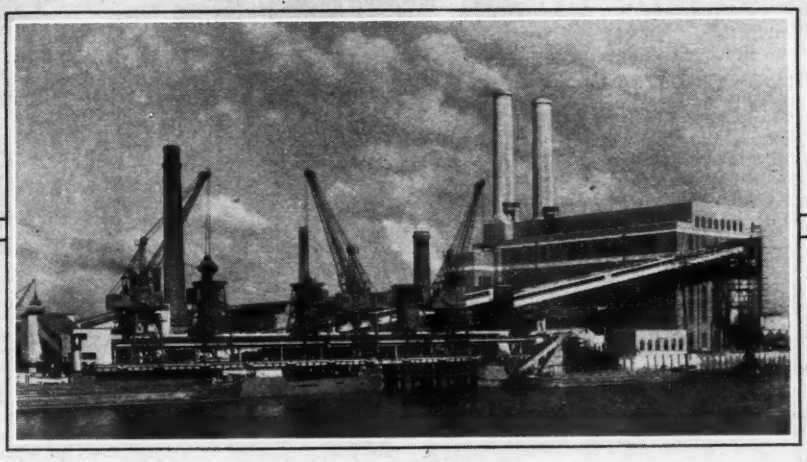
Left: Relationship between load factor and kWh sold for the past six years. Right: The load factor on comparable winter days before and after the Earls Court thermal storage plant was put into operation. A=Tuesday, 14-12-37. Load factor 85.02 per cent. B=Tuesday, 15-12-36. Load factor 52.12 per cent.

The 155 all-electric flats at West Kensington Court are expected to use over a million kWh annually

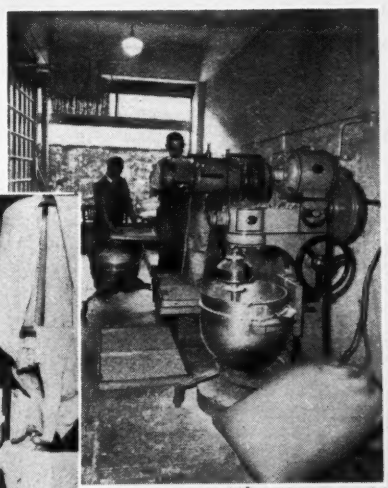
Cinemas are useful load-builders. The Regal takes some 180,000 kWh a year

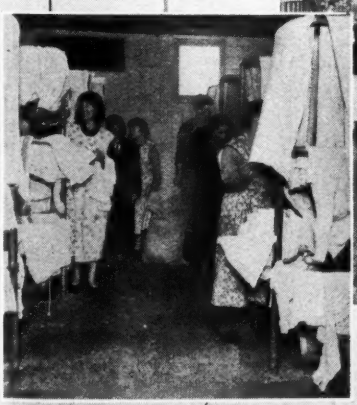


Much electrically operated machinery has been installed in the public washhouses at the Fulham baths



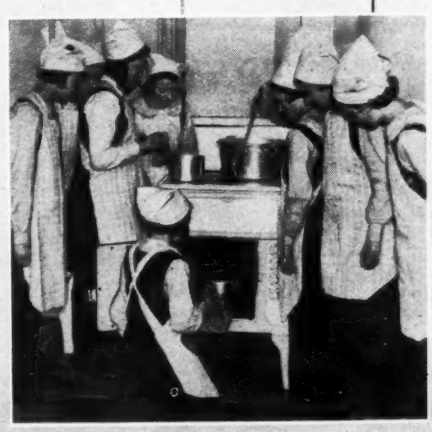
An electrically heated drying room is proving very popular at the Fulham Court flats





Mixing is carried out electrically at the macaroni factory of Tuckwell Products, Ltd.

Electric cookers are installed in all Council schools having domestic science centres. Below is seen a cooking lesson in progress at West Kensington Central School

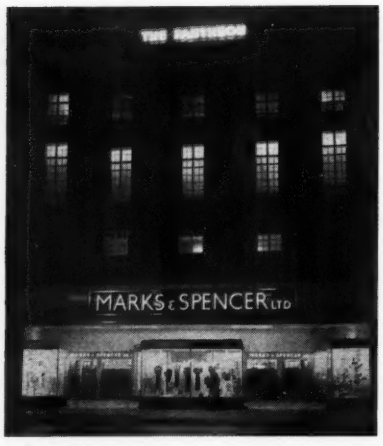


Misc. Rev. photos.

Fulham Power Station and some of its Customers. **(See p. 603)**

An All-electric Store

A combined system of electric thermal storage and panel heating



[*Elec. Rev. photo.*

A night view of Marks & Spencer's new store in Oxford Street, W.1

THE recent opening by Marks & Spencer, Ltd., of a new store on the site of the old Pantheon at 173, Oxford Street, London, is an event of more than usual importance to the electrical industry. Not only is it the first of the company's 233 stores to be heated by electricity throughout (it is, in fact, all-electric), but the installation indicates the growing appreciation of the advantages in architectural and engineering design which may be obtained by using electricity for heating buildings of this type. The operation of the plant will no doubt be followed with interest and we anticipate a widespread adoption of the system, or variations of it, in similar premises in the future.

A recent tendency in electric heating development is a combination of direct heating with complete air conditioning or mechanical ventilation, special care being taken to ensure definite air movement. Accordingly, in designing the installation, Central London Electricity, Ltd. (in collaboration with the architects, W. A. Lewis & Partners and Robert Lutyens; the heating and ventilating contractors, C. B. Jackson & Co., Ltd.; and Unity Heating, Ltd.), have utilised the cheaper method of applying electricity, namely, an evaporative cooling system operated from an electric thermal storage plant, for the major portion of the heating system, supplementary warmth being available from architectural panel heaters situated round the top of the ornamental main columns.

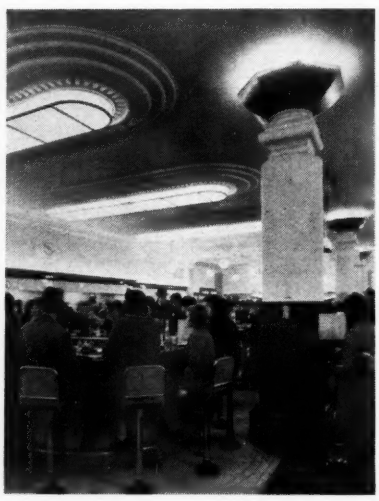
The ventilation system is designed to give six complete air changes per hour evenly distributed throughout the main showroom, a proportion of this air being utilised as return air to the main plant. The air enters the showroom at the top of the ornamental columns and returns at approximately counter level. The ductwork serving the inlets and outlets in the showrooms is situated at high level in the basement and from the ductwork four connections are taken to the base of each column, each connection being in ¼-in. plate steel fitted with automatic double fire dampers.

All air is passed through glass silk filters and then through a washer before entering the main ducts. The main fan, driven by a 32-h.p. Bull motor arranged for a 50 per cent. speed reduction, is of a double-inlet type having a duty of 30,000 cu. ft. of air per minute. A secondary heater battery is fixed on the outlet from the washer. This apparatus is capable of maintaining a store temperature of 60 deg. F.

Both the primary and secondary heater batteries are supplied with hot water from the electric thermal storage plant. This comprises a 100-kW Bastian & Allen low-voltage electrode boiler, complete with automatic load control, and a 3,000-gal. storage cylinder, the maximum water temperature being 250 deg. F. For the primary pump a ½-h.p. B.T.H. motor is employed, a ¼-HP Crompton Parkinson unit driving the secondary pump. The load is an entirely off-peak one and the whole of the apparatus is automatically controlled.

The architectural panel heaters, specially designed by Central London Electricity, Ltd., in collaboration with the architects and Unity Heating, Ltd., for fitting at the top of the pillars, each have a loading of 3.8 kW and there are, in addition, several half units loaded at 1.9 kW arranged for wall mounting. Altogether these heaters require 80 kW. They are thermostatically controlled, and as by good fortune the electrical peak and the occupational peak coincide (less heat and more ventilation is obviously required when the store is full), it has been arranged for them to be switched off by time switch two hours every morning and afternoon.

Ventilation of a café bar is carried out by means of an extract fan providing twelve air changes an hour. The air is extracted through concealed grilles in the ceiling and behind the service canopy. The service kitchen has complete inlet ducts and extract plant to give thirty air changes an hour, the inlet ducts being specially designed to inject the air at high velocity. Special ventilating units are also installed in the food storage rooms in a basement, the cooked meats room having additional apparatus for cooling the air in hot weather. Further extract apparatus is used for the staff kitchen, canteen and lavatories.



[*Elec. Rev. photo.*

The café bar. Note the ornamental columns on the right with agricultural panel heaters at the top and the ventilation extract grilles lower down

For the upper floors of the building which are used as offices, staff and rest rooms, &c., a different system of heating and ventilation has been adopted. As the rooms are scattered and can be easily ventilated by windows, it has been considered more economical, instead of employing a plenum system or hot water radiators operating from the thermal storage plant, to utilise either Unity convectors or tubular heaters, these again being thermostatically controlled. Their total loading is 120 kW. Panel heaters warm the unloading dock.

The heating and ventilating side, however, represents only a portion of the electrical plant, the total installed load being somewhere in the neighbourhood of 700 kW. About 170 kW of this is required for cooking and among the equipment to be found in the kitchen which serves the café bar are a Hobart potato peeler, a Crypto chipper, a Frigidaire refrigerator, and a quantity of G.E.C. apparatus, including two steamers (5 kW each) and two baking ovens (6 kW each). A Hobart dish washer taking 18 kW is installed in a separate room. A stainless steel finish has been employed for all equipment of the café bar itself.

[*Elec. Rev. photo.*

Thermostatically controlled convectors are used in the staff rest room

Here we noticed thermostatically controlled cupboards for warming plates; three steaming cabinets each incorporating two 4-kW immersion heaters for keeping hot such food as soup, mashed potatoes, sausages, pies, &c.; two four-slice toasters; a waffler; drink mixers; ice-cream cabinets; and special coolers for storing drinks. All the above-mentioned kitchen and café bar equipment was supplied by Ash's Manfg. Co. (Blackfriars), Ltd.

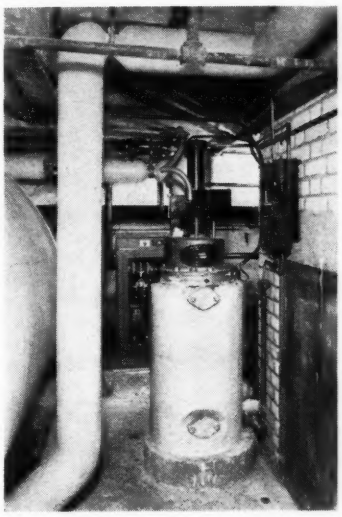
Serving the staff canteen is a separate all-electric kitchen equipped throughout by the G.E.C. Apparatus installed comprises steaming and roasting oven, hot cupboards, a boiling plate, a toaster, a potato peeler (Hobart), a fish fryer, a refrigerator and an immersion heater for boiling water for tea or coffee. Throughout the kitchen and also for wiring

the architectural panel heaters, "Pyrotenax" cable has been used on account of its resistance to heat. Mr. David Myer, a director of Davis Myer & Co., Ltd., the electrical contractors, says that its higher price is offset by a reduction in labour costs.

Water heating, too, for the various services is all undertaken electrically. Two 100-gal. heaters, loaded at 18 kW each, supply the café bar and kitchen, while the staff kitchen is served by two similar units with slightly lower loadings (12 kW). Each lavatory has its own individual heater, as also have some of the food storage rooms. In all, the thermostatically controlled Heatrae apparatus used takes 82 kW.

Lighting throughout the building is exceptionally good and so satisfactory are the lighting fittings installed in the showrooms that it has been decided to extend their use to all the company's other stores. The units, which are of the totally enclosed type with prismatic glass bases, are known as "Delmas" fittings and have been specially made by Falk, Stadelmann & Co., Ltd., to the design of the architects to give a high-intensity, non-glare illumination with good diffusion.

Supplementary illumination over the café counters comes from a strip of concealed cornice lighting and from ornamental box ceiling units. The latter, like the laylights used entirely for the shadowless window lighting, were produced by G.V.D. Illuminators, Ltd. Claudgen, Ltd., was responsible for some attractive neon signs and a novelty is the illumination of the heavy window curtains to create an impression of lighted windows from the outside. The lighting load is about 80 kW and for emergency purposes there is a remarkably compact 10-kW nickel-cadmium Britannia battery which supplies one lamp in every three. An alarm in the manager's office warns him when the emergency lighting is in operation. Charging is effected by means of Heayberd apparatus.



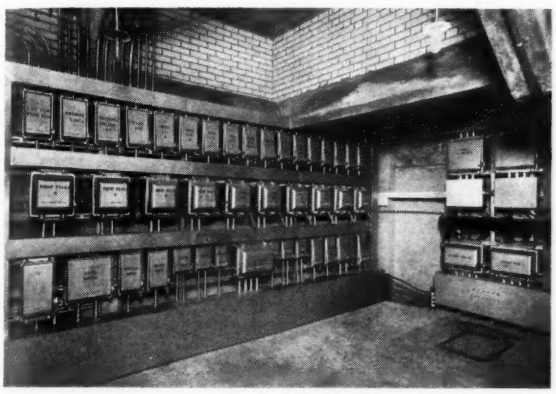
[Elec. Rev. photo.

The 100-kW Bastian and Allen electrode boiler

Full electrical services are also available for other purposes. Every counter is equipped with a 15-A plug and special arrangements are made for the electrical department. The telephone installation comprises twenty-four G.P.O. lines and eighteen Reliance intercommunication lines, while in addition to an Instanta combined clock and staff location system there is an International Time Recorder Co.'s clock for warning the staff for lunch, &c., intervals. Three Wadsworth lifts are provided for passengers, goods and service respectively. The various supplies of electricity for power purposes between them account for about 80 kW.

To handle the 400/230-V three-phase AC supply furnished by Central London Electricity, Ltd., a particularly neat main switchboard has been designed and constructed by Davis Myer & Co., Ltd. For this board "Monarch" type switch fuses incorporating h.r.c. fuses have been supplied by the Simplex Electric Co., Ltd., which was also responsible for the whole of the ironclad switch and distribution boards, switch-fuses, &c., throughout the building.

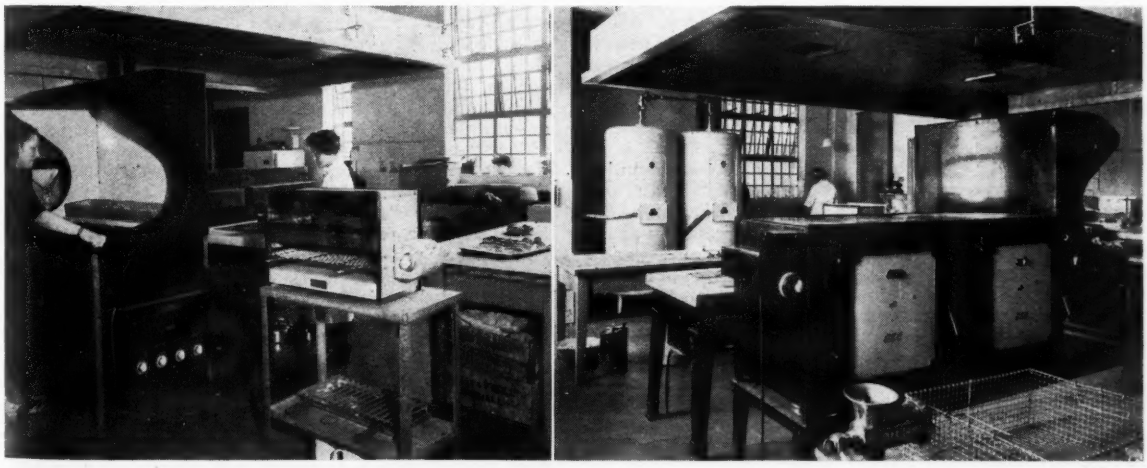
No less than 3,000 yards of paper-insulated cable and 200,000 yards of v.i.r. the installation, the main cables being laid in perforated metal trays. The necessary conduit, switchboard, duct work and a quantity of accessories were supplied by Falk, Stadelmann & Co., Ltd.



Simplex ironclad switch and fuse gear has been used by the electrical contractors for constructing this neat main switchboard

E.C.A. (Gloucester Branch)

THE annual dinner and dance of the Gloucester and District Branch of the Electrical Contractors' Association, in association with the Gloucester Branch of E.D.A., was held at the New County Hotel, Gloucester, on October 20th. Mr. R. Coombs (chairman of the local branch of the E.C.A.) presided. The toast of "The Electrical Industry" was submitted by Mr. C. G. Morley New (Electricity Commissioner) who stressed the importance of co-ordination between all sections of the industry, and expressed pleasure that so many sections were represented at the dinner. Mr. E. A. Reynolds (vice-chairman of the E.C.A.), who replied, said that the electrical industry was in the very happy position of showing continual increases in consumption, in the number of consumers, and apparatus sold. The industry was very little affected by slumps or booms in trade. That was because electricity was a general utility service. There was a lot of salesmanship required, however, to bring home to the ordinary householder the advantages and comforts that could be obtained from the use of electricity. The toast of "Kindred Associations" was proposed by Mr. L. C. Penwill, director and secretary of the E.C.A., who said that there were nearly 150 associations connected directly or indirectly with the electrical industry. He also emphasised the necessity for still further co-operation between all sections of the industry. Mr. F. Gale (Edison Swan Cables, Ltd.) replied, and urged the maintenance and extension of the bond of friendship existing between kindred associations and all sections of the industry.



[Elec. Rev. photos.

The all-electric staff kitchen, showing (left) the fish fryer and griller and (right) the water heaters, hotplates and ovens

The Electric Vehicle's Sphere

From a Correspondent

More and more the advantages of the electric vehicle for short-run work involving frequent stops and starts is being recognised. Electricity supply authorities should encourage the movement as these vehicles represent a useful off-peak load.

IT is important when considering the use of an electric vehicle to remember that it is essentially designed for a specific purpose. The existence of a demand for a more economical form of transport in town and suburban deliveries, creates a sphere of activity for which the "electric" is ideally suited. In house-to-house delivery or collection the smooth and rapid acceleration of the electric enables it to cover the few yards in between stops in as short a time as a vehicle capable of running at three times the maximum speed of the electric. Actually, in a great number of cases it has been found that on the same round an electric has reduced by a considerable amount the time previously taken in completing a day's delivery.

Access to and egress from the driver's position is conveniently arranged by the low step to the cab and the absence of a gear-box allows for an immediate start to be made from the standstill position. There are no reciprocating parts on an "electric" and as the movements are rotary there is consequently less wear. The even torque imposes far less strain on the chassis with the result that the vehicle can be depreciated on the basis of a ten years' life. "Fuel" in the form of batteries is generally slung underneath the chassis so that no body space is taken up and the method of mounting in many cases allows for their easy removal for examination if required.

Much harm has been done, however, to the electric vehicle business by too optimistic claims of an electric's abilities. It should be admitted at once that where the work consists of transportation over a long distance with few stops the electric cannot compete with a petrol vehicle. The prospective user of an electric should realise that when he plans his round of deliveries to use up the full capacity of the battery, he has no margin left to extend the activities of that particular vehicle, and unless he has a set round on which he can work his electric he should discuss that aspect of the matter thoroughly with a reputable battery manufacturer in order to avoid disappointment.

Battery Hire

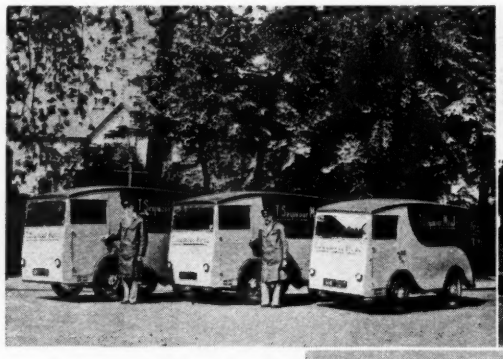
Many users take advantage of a hire service obtainable from most battery manufacturers, which enables them to hire the battery at a flat annual rate over three years; in this way they are assured of a definite battery cost per annum, but on the other hand, many batteries last more than three years—with consequently a reduced final battery cost over the whole period. If the battery is bought outright much can be gained by intelligent organisation of a vehicle's round. One large dairy in Eastbourne found that its deliveries could be so arranged that the hilly parts of the routes were worked towards the end of the rounds when the loads were appreciably lighter, with a useful saving in current.

Generally speaking, a distance of 30 miles per charge can be taken as an average figure for a light vehicle counting stops, but if the user is satisfied with a lower speed he can use a battery with a smaller capacity than if he requires a top speed throughout the day. It should be remembered also that with a lower gear ratio greater mileage can be obtained—but speed will be cut down. Batteries of the lead-acid type are generally chosen for electric vehicle service, and whilst to-day all makes of lead-acid batteries are guaranteed for a period of three years, reasonable care in maintenance and operation will result in a considerably longer life being obtained.

The marked increase of users of electric vehicles during recent years has resulted in electricity authorities fully recognising the importance of the remunerative load afforded by electric vehicle battery charging. It is interesting to note in this connection that in January, 1938, Ministry of Transport returns showed over 3,500 vehicles registered. If we strike an average of 20 cwt. per vehicle (this allows for light electric hand-barrows, etc.), the annual night load for recharging of batteries is in the vicinity of sixteen and a half million units. It will be appreciated that, this being a night load involving the supply authorities in a minimum of expenditure, its revenue is a very valuable acquisition.

This supply of current for charging is an important point which can affect the usefulness of a vehicle whose round necessitates a boost charge at certain hours. Some authorities provide current for 24 hours with no restrictions, others increase the cost per unit for certain hours of the day, whilst others allow a boost period (without increased cost) for a certain period, the supply being cut off by a time switch. At the present time only the fringe of the market for electrics has been penetrated, and with the normal development which can confidently be anticipated, the available load will assume astronomical proportions.

One large user of electrics—a baker operating a fleet of over



Top left: A smart fleet of vehicles built by Electricars, Ltd., for a Manchester firm of provision merchants. Top right: A Partridge-Wilson tower wagon employed by the Morecambe and Heysham Borough Council. Below: A Victor Electrics delivery van. These vehicles are all equipped with "Exide-Ironclad" batteries

fifty vehicles—finds from his service records taken over a period of two years that the average cost of maintaining the vehicles in perfect working order is under £1 each per year. Since these vehicles were supplied—more than four years ago—not one of their original batteries has had to be replaced. This particular firm was so impressed with the economy of its original fleet that it has since ordered a further twenty vehicles of the same type.

An interesting and valuable comparison between the actual costs of operating electrics as against horse-drawn vehicles is supplied by the Cleansing Superintendent of Grimsby Corporation, where the present fleet of vehicles comprises six 2-ton "Electricar" vehicles purchased in 1921, one 2-ton "Clayton" interchangeable vehicle for refuse collecting or street watering, purchased in 1922, and two 30-cwt. low-loading "Electricar" vehicles bought in 1928 and 1931 respectively. After 17 years' service the six "Electricars" are said to be in as good condition as when they were put into service, and have seldom been out of commission except for a minor repair to a ball race or an occasional spring, caused by the irregular surfaces of sleeper roadways at controlled tips. With regard to the batteries, which are "Exide-Ironclad," it is stated "We find that a battery will run a vehicle for at least four years before showing any signs of getting to the end of its useful life." The following data also supplied shows that although

the old horse-drawn vehicles collected, during four weeks, 72 loads more than the electrics, the latter's total tonnage was approximately twice as large :—

COLLECTION COSTS FOUR WEEKS ENDED JAN. 26TH, 1938.

Six 2-ton vehicles (3 *gangs*)—	Per week each. £ s. d.	Totals (4 weeks). £ s. d.	£ s. d.
Wages and Insurance			
6 drivers	3 10 2	84 4 0	
3 gangers	3 2 3	37 7 0	
15 loaders	2 18 4	175 0 0	
			296 11 0
	Per week per vehicle.		
Energy cost	13 0	15 12 0	
Boosting expenses (night charging)	9 4	11 4 0	
Lubricants, oil and grease	0½	1 6	
Tax (£46 13s. 4d. per annum)	18 0	21 12 0	
Insurance (£6 10s. 0d.)	2 6	3 0 0	
Tyres (solid rubber, £19 3s. 0d. per set, 4 years' life)	1 10	2 4 0	
Other maintenance	2 6	3 0 0	
Battery renewal (£154 9s. 5d., 4 years' life)	14 10	17 16 0	
			74 9 6
Total costs			£371 0 6
Total tonnage collected, 856.35.			
(Average journey to disposal point, 1¾ miles).			
Cost per ton			8 8
Six horse-drawn vehicles (3 *gangs*)		£ s. d.	£ s. d.
Wages and insurance—			
6 drivers (at £3 2s. 0d. per week)		74 8 0	
3 gangers (at £3 2s. 3d. per week)		37 7 0	
6 loaders (at £2 18s. 4d. per week)		70 0 0	
Net proportion of stable expenditure, provender, shoeing, harness, etc.		38 8 0	
			220 3 0
Tonnage collected, 485.55 tons.			
Average journey to disposal point, ¼ mile.			
Cost per ton			9 9

Operators who have changed over from horses to electrics have found that the simplicity of the electric extends to its manœuvring abilities. What might at first appear to be an almost insuperable problem—that of retaining old and trusted employés who are already familiar with their rounds—merely calls for a few hours' driving tuition, and the ex-horse driver, with his accumulated store of road-sense generally has no difficulty whatever in passing his driving test.

Many prospective owners of electric vehicles are inclined to hesitate over the ability of their men properly to look after the battery. Manufacturers of the better known makes of batteries are aware of this and provide a free inspection service which ensures that the battery gives of its best over the longest possible time. In our times, when preparations and precautions loom largely in our everyday lives, prospective users of electric vehicles should not lose sight of the fact that such vehicles rely solely on fuel produced at home, and are not dependent on supplies which in time of emergency might be seriously restricted. Fire risk is practically non-existent—a valuable feature which is reflected in lower insurance premiums.

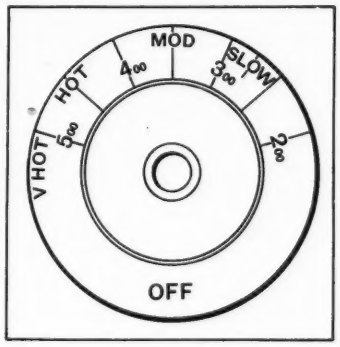
In general, electrics between 7½ cwt. to 1 ton are fitted with batteries rated at from 50 to 60 V, the capacities ranging from 150 to 200 Ah at the five-hour rating, depending on the range specified. When excessive demands are made on the capacity of a battery on an early morning round it is possible to give it a boost-charge during the lunch-hour, when sufficient ampere-hours can be put into the battery to enable the afternoon's round to be completed, or a standby readily interchangeable battery can be used. At night all that is necessary is to insert the charger-plug into a socket provided on the vehicle and switch on the charger—which automatically cuts out when charging is complete; then in the morning the driver finds that his batteries are fully charged and ready for a full day's work.

With threatened restrictions upon the use of horse traffic in city areas, the mechanical horse has been developed. The petrol horse has been a familiar sight for some years, but recently, after considerable experiment, the electric horse has appeared on the market. There would appear to be a very large field for the use of these powerful machines for transport from docks, railways and warehouses, and electricity supply authorities would do well to investigate the possibilities in their own areas and help to develop an extremely useful additional load in conjunction with the Electric Vehicle Association whose work was dealt with by Col. G. D. Ozanne in the ELECTRICAL REVIEW of August 26th.

Standardisation of Cooker Thermostats

E.D.A. committee's recommendations

THE advent of the thermostatic control of electric cookers has brought with it a problem which should be solved before the employment of the system attains the dimensions which it is expected to reach. This is the proper method of calibrating the control dial. A diversity of practice exists in the gas industry and the manufacturers of electric cookers are also adopting different markings. The matter has been considered by the E.D.A. Electric Cooking Committee, which has made recommendations.



A sketch of the dial which has been evolved by the E.D.A. Committee. The addition of the words is optional and contingent upon space being available

The Committee found that three methods were in vogue, namely (1) The Fahrenheit scale in full, *i.e.*, 100, 200, 300, 400, 500 deg. F.; (2) Single figures representing hundreds of degrees F., *i.e.*, 2, 3, 4, 5, sometimes with an indication of their meaning; and (3) Numbers corresponding to the "Regulo" scale used on some gas cookers, *i.e.*, ¼, ½, 1, 2, 3 . . . 14. An endeavour was made to ascertain the views of supply engineers and a questionnaire was sent to all members of the Association with more than 1,000 cookers connected. It was found that there was an overwhelming preference for one or other of the first two methods, with a large majority in favour of full degrees.

It was decided that a compromise between these two systems of marking should be recommended for general adoption. The recommended scale consists of large figures—2, 3, 4 and 5—followed in each case by two small noughts, the advantage of this being that the important figures are large and easily read, while the small noughts will assist the user to realise that it is essentially a Fahrenheit scale from which she can select any temperature recommended in a cookery book for a particular dish, for example, 450 deg. for roasting meat.

In this connection it is intended that the calibration or adjustment of the thermostats shall be such that the temperatures maintained will correspond with the readings of degrees previously recommended by the Committee in connection with oven door thermometers for the different zones of heat as required in cooking, namely: "Slow," 275 deg.; "Moderate," 350 deg.; "Hot," 450 deg.; and "Very hot," 500 deg.; in other words, when a thermostat is set at 500, the heating condition of the oven should be what is generally known as "Very hot," *i.e.*, suitable for cooking pastry, etc.

The resolution of the Committee embodying this recommendation with regard to thermostat markings also proposes that thermostat pilot lamps, where used, should be connected so as to be alight when the thermostat contacts are closed. It is further recommended that thermostat controls should turn in a clockwise direction to increase oven heat, as in the accompanying sketch.

This resolution has been approved by the Council of the Association, and at the last meeting of the Cooking Committee the effects of the resolution were reviewed and manufacturers' representatives stated that they would conform to the recommended standards as soon as existing stocks were exhausted. It is therefore expected that the recommendations will become standard practice in the industry.

Employment in September

Employment showed a further slight decline between August 15th and September 12th, but was fair on the whole. According to the *Ministry of Labour Gazette*, in electrical engineering there was little change and employment continued good. The number of unemployed in the engineering industry was 98,412, or 8.4 per cent., an increase of 0.4 per cent. as compared with August, and 3.6 per cent. as compared with September, 1937. In electrical engineering the number of unemployed was 6,243, the percentage remaining at 5.4 (2.7 per cent. in September, 1937). In the electrical wiring and contracting industry the number out of work was 4,421, the percentage falling from 11.1 to 10.7 and comparing with 12.3 per cent. in September, 1937. In the electric cable, apparatus, lamps, &c., group the unemployed totalled 12,160, representing a percentage of 6.8, a decrease of 0.4 per cent. as compared with the preceding month, and an increase of 3.1 per cent. as compared with the corresponding month of last year.

Electricity Supply in Great Britain

Annual report of the Electricity Commissioners

WHILE the increase of 2,480 million kWh generated during the twelve months ended March 31st last was the second largest recorded in any year, the rate of advance declined towards the end of the period due to a falling off in the level of industrial production and possibly also to the effect of the abnormally mild weather on the demand for heating. The final result shown in the eighteenth annual report of the Electricity Commissioners for 1937-38 (Stationery Office, 3s.) is that the kWh generated by authorised undertakings, 23,349 million, exceeded the amount for the previous twelve months by 11.9 per cent.

Based on figures for 1937, selected stations generated 93.5 per cent. of the total kWh generated. Upwards of 14 million tons of coal and coke breeze were used, giving an average production of 1,571 kWh per ton compared with 1,200 kWh in 1930. Marked increases in the cost of coal have occurred during the past two years above the previous average minimum of 14s. 9d. per ton including transport and handling charges. These increases have been in excess of the extra 1s. per ton on contract prices to which the electricity supply industry agreed in 1935-36 on condition that the whole addition would be paid in higher wages. In 1936-37 the enhanced cost of coal more than offset the savings due to the grid, and for 1937-38 a further advance is probable. The advances have been reflected in bulk supply charges and in the cost of electricity to large power consumers supplied under agreements subject to adjustment for fuel costs. Up to the end of 1937-38 no increases in tariffs are known to have been made to ordinary consumers on this account.

More than three-quarters of the output of selected stations came from thirty-five stations each generating over 200 million kWh. Public authorities were responsible for about 54 per cent. of the kWh generated (but 63 per cent. of the kWh sold) by authorised undertakings in 216 out of 392 stations. Only 6.5 per cent. of the total was provided by non-selected stations. A table giving particulars of kWh generated in grid system areas for two years shows that 31.5 per cent. is produced in S.E. England.

The report covers the operations of 591 separate undertakings—the Central Electricity Board, 369 local authorities, 213 companies, three J.E.A.'s and five joint boards of local authorities. It also gives some statistics relating to thirty-two stations owned by traction and certain non-statutory undertakings. The number of stations dealt with is eighteen less than in the previous year, mainly due to discontinuance of generation in several cases. Sales of electricity by authorised undertakings were equivalent to 414 kWh per head of the 1937 population (46 million).

Power Station Extensions

At the end of 1937-38 there were 137 selected stations in existence and sanctions were issued during the year for extensions to some of them by a total of 645,000 kW. The extensions include a 100,000 kW set for Battersea (London Power Co.), 75,000 kW for Barking (County of London Co.), 50,000 for Blackburn Meadows (Sheffield), two of 45,000 for Ferrybridge (Yorkshire E.P. Co.), and 53,500 for Hams Hall (Birmingham).

Sanction was given to the borrowing by public authorities of £19,726,000 (a decrease of 18 per cent. from the previous year), of which 49 per cent. was in respect of mains, services, meters and instruments, and 31.4 per cent. for plant.

An appendix to the report gives particulars of sanctions given to thirty undertakings to alter their systems of supply. These mostly related to changes from DC to AC at the standard voltage, with one case of change of frequency and voltage. Four applications for approval to the interconnection of high-voltage systems which were connected to earth at one point were granted with the concurrence of the Postmaster General. Special regulations were made in nine instances permitting the insertion of reactance coils in earth connections at specified points to suppress arcs to earth. A small isolated undertaking was authorised (in order to avoid its running at a loss) to discontinue the supply of energy to consumers between the hours of 12.30 a.m. and 6.30 a.m. each day for twelve months.

In view of the satisfactory operation in adverse weather of high-voltage overhead lines with small line conductors, experimentally constructed under a modification to the Overhead Line Regulations for giving supplies to isolated consumers, the Commissioners have decided to approve in appropriate cases special factors of safety. These will be calculated on a basis of a covering of ice to a radial thickness of $\frac{3}{16}$ in. for line conductors ranging from No. 8 SWG to 0.04 sq. in. of copper (or copper equivalent for composite conductors) and for sizes not larger than 7/14 SWG with steel or mainly steel conductors. Supports for such conductors in conjunction with struts or stays must withstand longitudinal, transverse and vertical loads due to this ice-loading and to the wind-pressure specified in Regulation 15; wooden supports must have a diameter of not less than 7½ in. at a point 5 ft. from the butt end. The payment by seventeen undertakings of subscriptions to the E.R.A., E.D.A., B.S.I., I.M.E.A. and E.A.W. was sanctioned.

Approval was given in 115 cases to the construction and pattern of meters submitted for test at the National Physical Laboratory. Extended reference is made to the procedure for the testing and certification of meters that came into force on July 1st of this year and to the new limits of error permissible (*i.e.*, +2½ or −3½ per cent. at any load).

Research Reports

Reports have been received from the E.R.A. and made available to the supply industry regarding tests on machine-made concrete poles, the measurement of earth resistance of overhead-line towers, the use of coke as an earth electrode and the voltage gradient around earth electrodes. The Commissioners have asked the E.R.A. to investigate high-voltage current testing and its associated fundamental phenomena and the relation between power factor and incipient failure of electrical equipment, and have agreed to contribute £1,000 towards the cost of the inquiry. Total administrative expenses, to be met by authorised undertakings in proportion to kWh sold, other than in bulk, amounted to £70,000, which works out at 1.01d. per 1,000 kWh sold. A levy of £736,000 was made in respect of standardisation of frequency based on revenue received by authorised undertakings from the sale of electricity (other than bulk supplies) which in 1936 reached £76,462,000.

Among the appendices to the report is one giving tabulated particulars of five rural electrification schemes, *viz.*, Bedford, Norwich, Dumfriesshire, Kircudbrightshire and Shropshire. Others summarise proposals by undertakings for supplying electricity in undeveloped portions of their areas, and give brief particulars of Special and Fringe Orders, non-statutory works and compensation awarded for loss of office.

Industrial Consumption

A new appendix this year sets out the amount of electricity consumed in 1935 and 1930 in factory and non-factory trades included in the Board of Trade Census of Production statistics. This reveals that the aggregate consumption amounted to 15,245 million kWh in 1935, as compared with 11,693 million in 1930. If the consumption by public supply undertakings and the generating stations of transport undertakings is excluded, the corresponding figures are 14,193 million kWh and 10,960. Of these amounts 7,477 million kWh and 5,335 million kWh were purchased. Mines and quarries were the largest trades resorting to private generation, producing 1,914 million kWh from their own stations in 1935, a reduction of 9.5 per cent. from the 1930 figures; at the same time they increased their purchases by 23 per cent. to 894 million kWh. Iron and steel works generated 936 million kWh in 1935 (27 per cent. increase over 1930), and purchased 1,020 million kWh (64.9 per cent. increase). Textiles relied upon private generation to the extent of 570 million (34.7 per cent. increase) and on purchased power for 926 million (32.7 per cent.). Paper printing and stationery trades generated 1,077 million kWh in 1935, an advance of 69 per cent. upon the 1930 returns.

Particulars of coal consumption are also given for various trades, the aggregate being 100,743,000 tons. The amount of heavy fuel oil consumed was 233,485,000 gal. Gas undertakings and the iron and steel trade took over 35 million gal. each, whereas electricity undertakings accounted for but a little over 5 million gal. or about 2.2 per cent. of the total for all trades.

At the end of January Sir John Snell (who has since died) retired and was succeeded as chairman by Sir Cyril Hurcomb and Mr. J. M. Kennedy was appointed deputy-chairman. The third Commissioner is Mr. C. G. Morley New and the chief engineering inspector is Mr. H. Nimmo.

Leipzig Spring Fair

The General Samples Fair of the Leipzig Spring Fair will be held from March 5th to 10th, 1939, and the Great Engineering and Building Fair from March 5th to 13th.

Iron and Steel Practice

Electric drive and furnaces

AFFAIRS in Europe caused the cancellation of the autumn meeting which was to have been held in Canada and the U.S.A. jointly by the IRON AND STEEL INSTITUTE and the INSTITUTE OF METALS. Instead there have been separate one-day meetings in London this week (October 26th and 27th) at which a few papers were read or communicated.

Among the latter was a paper with illustrations and drawings by Mr. Quincy Bent (Bethlehem, Pa., U.S.A.) descriptive of modern rolling mill practice in America, exclusive of continuous strip and sheet mills. The development of suitable driving motors and control gear has contributed largely to recent improvements and successful operation, says the author who points out that from an operating point of view the measure of merit so far as the electric drive is concerned is one of performance. The efficient transmission and insignificant stand-by losses of electric power have led to its extended use. Standardisation has been a keynote in electrical development. Motors are duplicated to eliminate costly spares and facilitate quick repairs. In modern plants at least a portion of the power consumed is generated, principally to guard against power interruptions from outside supply lines and also to utilise by-product gases for gas-engine-driven generators or the generation of steam to drive turbo-generators. The transmission systems are usually above ground and are arranged in "loops" with the possibility of several sources of power supply to avoid a shut-down from possible isolated interruptions. Electricity has for years been well established for drives and more recently has come into use for furnaces, such as for heat-treating and annealing; also electroplating and electrolytic cleaning give promise of an expanding use for electricity.

Main roll drives include some of the most highly specialised electrical equipment in a mill, and experience has proved that these units can be operated and maintained with comparative ease and economy far beyond a similar steam-driven unit The general types of mill-drive motor applications are: for constant speed mills the generally accepted practice is to use the slip-ring induction motor, either directly connected or through the reduction gearing to the mill pinions. For reversing mills single- or double-unit 600-V DC motors are direct-connected to the mill pinions. Recent installations utilise separate drive motors on each mill roll, eliminating the mill pinions entirely. On slabbing or wide-flange structural mills, separate DC drives are used for the main rolls and vertical or supplementary rolls. The Ward-Leonard system of control is provided for the mill motors, and a liquid slip regulator forms a part of the control of the induction motor driving the flywheel set.

Continuous and Reversing Mills

Continuous mills and bar mills now employ unit DC drives on the finishing stands, giving better speed control over wide ranges than the more common single motor and gear train on the older mills. Scherbius and Kramer sets using AC energy are applicable to this type of mill if the speed requirements are within a reasonable range.

DC power for reversing mills is supplied from flywheel motor-generator sets driven by slip-ring induction motors, while the continuous mills, having a more constant load factor, employ synchronous motor-generator sets. It is the practice in the modern mill to house the main-roll driving motors with the control equipment in substantial rooms adjacent to the mill stands. These rooms are in effect "air-conditioned," considerable care being given to that aspect to protect and prolong the life of the expensive equipment. In addition to the drive motors, the 250-V motor-generator sets for DC power and step-down transformers are situated here, so in reality the rooms become sub-stations, all under the control of one mill operator.

The following table shows the average power consumption per ton for different types of mills.

Type of mill.	kWh per ton.
54in. blooming mill	15
44in. blooming mill	14
48in. wide-flange structural mill	43
36in.-32in. rail mill	31
35in.-28in. structural mill	41
18in.-14in. structural mill	59
10in. rod mill	78
12in. skelp mill	41
110in. sheared plate mill	23
48in. universal plate mill	34
12in. bar mill	32
8in. bar mill	49

Mill auxiliary drives fall within three general duty classes: heavy or light intermittent reversing and non-reversing service; adjustable-speed continuous and intermittent service; and constant-speed continuous and intermittent service. To the first of these the DC series-wound mill-type motor is applied; for the second DC shunt- or compound-wound, and for the third squirrel-cage, slip-ring or synchronous AC motors are used. Magnetic control is preferred for all mill auxiliaries, control panels being grouped and protected in galleries or rooms. Energy at 250 V DC for auxiliary drives is supplied from synchronous motor-generator sets or rotary convertors, preferably the former for greater power-factor correction. AC is used as widely as possible, since the conversion loss to DC is about 10-13 per cent.

The use of individually motor-driven rollers for mill tables is now accepted practice, particularly for light high-speed equipment. Two types are used; in one the motor is an integral part of the roller, and the other has a small motor connected externally to the roller. Both offer the advantage of more dependable service, since one defective motor will not put a whole length of table out of service as in the case of line shaft or gear drive.

Improved mill lighting with high-power lamps and properly designed reflectors contributes to safety in the operations. For special work, such as inspection or roll turning, sodium vapour or mercury vapour lamps are employed.

The development of continuous strip mills is reviewed in a shorter paper by Mr. D. Eppelsheimer (Middletown, Ohio, U.S.A.). A device for automatically recording the variations of sheet cross-section, with magnification by electrical means, is referred to.

An account of the new steel plant of the Mysore iron works at Bhadravati, India, is contained in a paper by Mr. D. V. Krishna. It includes a small basic open-hearth furnace with electric forced draught fan and electrically operated gas valves. The rolling plant is served by two overhead cranes, the roughing mill being driven by a 600-HP motor, while the finishing mill is driven by a DC motor of 1,000 HP with provision for speed variation from 200 to 400 RPM.

Steel Furnaces

Electric furnaces in European steelworks are discussed in a paper by Mr. D. F. Campbell (London), who mentions the smelting of iron ore briefly, but describes in greater detail arc furnaces for steelmaking and also the development of high-frequency furnaces. The principal characteristics of several recent furnaces are stated and typical British and Continental installations are compared and illustrated.

Shaft furnaces are now being replaced by pit furnaces of comparatively simple design in which the rich gases are collected and used for general heating purposes. This industry of iron smelting in pit-type furnaces has been established in Norway, Sweden, Finland and Italy, where conditions favour electric smelting.

A large number of arc furnaces for steelmaking has been constructed during the last five years in British and other European steelworks, and almost all constructors have returned to the simple three-phase furnaces with three electrodes. There is a strong body of opinion that considers a three-electrode furnace with a capacity of about 30-40 tons for liquid metal or 20 tons for melting cold scrap, of 8,000-10,000 kVA, as the largest unit that it is convenient to operate.

There is comparatively little difference in the power consumption between large and small high-frequency furnaces, the usual figures varying from 600 to 800 kWh per ton, according to the quality of steel manufactured or the metallurgical operation performed. The efficiency of modern high-frequency machines, especially of the homopolar type, is now so high and the electric furnace losses are so low that there is little hope of substantial improvement, and it is in the metallurgical field that there is much development work to be done. Considerable effort has been made in Europe to construct induction furnaces having violent and controlled movement in the bath. Large sums of money have been spent, but in many cases without a full understanding of the metallurgical problems, and, as a result, furnaces showing most interesting electrical phenomena have been built, and abandoned because no metallurgical advantages were established. This field of investigation of simultaneous motion and heat control is full of promise, and points to great possibilities of furnaces operating in high- or low- or dual-frequency electrical fields.

Arc and Low Frequency Furnaces

A paper by Messrs. W. M. Farnsworth and E. R. Johnson (Massillon, Ohio, U.S.A.) outlines American practice as represented by arc and low-frequency furnaces at the Canton works of the Republic Steel Corporation. The predominating types are the conventional Héroult arc and the high-frequency induction furnace. Low-frequency induction furnaces are few, and generally ingot-producing furnaces are basic, while the foundry furnaces for castings have acid linings. They range up to 100 tons, with usual sizes of 6, 15 and 25 tons capacity.

In the United States the arc furnaces are used for the

Training for Industry

Dr. A. P. M. Fleming's presidential address to the I.E.E.

IN his inaugural address as president of the INSTITUTION OF ELECTRICAL ENGINEERS in London on October 20th Dr. A. P. M. Fleming (Metropolitan-Vickers Electrical Co., Ltd.) pointed out that forty years ago practically the whole of the invested capital, employment, and manufacturing activity of the industry was concentrated on heavy electrical plant and apparatus, whereas at the present time the light-current side actually exceeds, at any rate in production, the value of the heavy-current side.

Modern manufacturing organisations have in many instances grown to great size, requiring a range of personnel quite different from that of earlier years and affording scope for every type of ability and aptitude. An important feature has been the increasing ratio of staff to manual workers. One reason for this is the intense need for efficiency in manufacturing operations, which has called for a considerable increase in the number of high-grade staff on the lines of communication between the management and the productive workers.

The changes affecting the skilled manual worker have been equally marked. The growth in application of mass-production methods has diminished the demand for certain types of handicraft skill, but has greatly increased the demand for workers skilled in making the tools of production. The manufacturing branch of the industry employs nearly 70 per cent. of all the workers engaged in the industry as a whole.

The new President of the Institution draws upon his wide experience to lay down the principles governing the selection of entrants to the various branches of modern electrical engineering, their education and training and their ultimate employment. He suggests co-ordination in these matters between large industrial organisations.

Personnel

The personnel problem is primarily that of selecting, educating, training and effectively using workers best suited to the various grades of employment, and its importance is such as to justify the use of every resource that will advance these objectives, since the prosperity and progress of any industry depend essentially on the adequacy and efficiency of its personnel.

The first consideration is that of selection. This is a matter of equating the aptitude of the entrant to the requirements of the job. Dr. Fleming is of the opinion that for most types of industrial employment, especially those concerned with the skilled trades, the best results are obtained when methods of self-selection are employed and the entrant is given an opportunity, after he has had some manufacturing experience under sympathetic guidance, of deciding for himself the trade or branch of work to which he is best suited.

The entrants from the lowest educational level (primary schools) on the manufacturing side are destined to become manual or junior clerical workers, although many technical schools offer workshop instruction, while, alternatively, many large engineering manufacturers seek to accomplish it even more effectively through their own works schools. Within the last quarter of a century the growth of junior technical schools has been one of the significant developments in industrial education. These schools do not, however, so far as Dr. Fleming has been concerned, contribute very prominently to the supply of craftsmen, since the great majority of their students experience little difficulty, on the completion of their apprenticeship training, in obtaining junior staff positions. They do assist materially, however, in filling that important need for an adequate supply of "non-commissioned officers" of the foreman and the works superintendent type.

With regard to the intermediate and higher educational levels, young men from the secondary and public schools, technical colleges and universities, after suitable training, proceed to staff employment. An alternative course which has many advantages comprises one year of practical training in works prior to, and one following, the university course. This provides an opportunity for the youth of 16 to 18 years, who up to this time has had no experience to guide him and who may have shown no special aptitude for any particular vocation, to learn at first hand what engineering is like without prejudice to his future career. The character of the practical training is important. One of its purposes is to give the young engineer experience of the main divisions of the manufacturing industry, *viz.*, design, production, selling, and research, so that he may determine for himself to which of them he is most attracted, and to solve for himself the equation of his aptitude and ability to the requirements for success in a chosen branch.

As regards the technical side of his training, the education now available in the universities and technical institutions requires careful consideration in the light of modern requirements. In the past, industry looked to the universities to supply students who were fully equipped technically. The position to-day is that with the immense amount of research that is done within individual organisations and the rapidity of development of new engineering plant and apparatus, the leadership in technical advance lies with industry, and it has now become increasingly important to consider the student from the university as one whose general education has been supplemented by a sound study of the principles in pure and applied science, which is to constitute the basis for the acquisition of more specialised technical knowledge when he finds his bent and field of work in the industry. This condition has been recognised in Manchester by the recent establishment of post-advanced regional courses of technical instruction in electrical and mechanical engineering.

Throughout his consideration of personnel, Dr. Fleming urged that a young engineer should determine for himself, by preliminary experience, the line of work to which he feels most attracted and in connection with which he can satisfy himself that he possesses the ability to carve out a successful career. This, however, is only the starting point; in his experience the young engineer who has been satisfactorily trained technically often, given an opportunity for the exercise of initiative, develops his inherent personal qualities in such a way that they may eventually outweigh the value of his technical knowledge. The rapid development of research in industry in recent years has brought about the need for special and appropriate staff, and the most suitable training for such staff is still a matter for determination.

The training of staff for the higher executive positions has become more and more a matter of grave concern, for the maintenance of our position in international competition depends essentially on good leadership. It behoves every concern to look ahead and be prepared to earmark its progressive staff officers at a relatively early age and give them the requisite breadth of experience, even at the risk of having to carry some supernumerary staff, in order to provide a force from which the highest executive positions can be filled.

Research

The other basic factor to which Dr. Fleming referred, namely, research, relates to the scientific testing of an idea, the research required to see whether it has application to any particular industrial objective, the semi-scale experiments to evaluate its economic possibilities, the provision of capital for its exploitation, the training of staff, and the provision of equipment to turn the idea thus developed into concrete

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Iron and Steel Practice.

(Continued from previous page)

manufacture of many grades of steel for the purpose of obtaining quality, uniformity of product, close chemistry control, special and complicated analyses. Many of the special carbon tool steels, the highest quality alloy steels, the aircraft steels, the semi- and full corrosion-resistant steels, the special heat-resisting steels, the alloy tool steels and the high-speed steels are made in the basic arc furnaces.

A Chemist's Views

Several of the Institute of Metals papers detail the results of X-ray diffraction studies of alloys, while the presidential address of Dr. C. H. Desch (N.P.L.) presented a chemist's view of metallurgy and classed the determination of crystal structure by means of X-rays as the chief of the newer physical methods of study.

In no instance had a structure established on a chemical basis been shown by X-ray investigation to be erroneous, but X-ray analysis was often a rapid means of deciding between possible alternatives.

Without seeking to undervalue the precious help afforded by physics, Dr. Desch pointed out that it was characteristic of chemistry that its astonishing growth had been made with the use of the bare minimum of hypothesis. He went on to explain how the etching of specimens for microscopical examination might produce false impressions due to an effect that was electrolytic and might be used as a means of investigating solid solutions more minutely.

Meetings and Discussions

A number of directions in which electrical service could be improved were pointed out by Mr. Fennell in his address to the North-Western Centre of the I.E.E. last week. At a meeting of the London Local Technical Group of the E.P.E.A. Mr. J. H. Parker stated the case for the trolley bus and gave some opinions on operation problems. The President of the "Mechanicals" chose a subject for his address closely allied to that of Dr. Fleming dealt with on page 612.

Suggestions for Improvement

THE I.E.E. in particular, and the electricity supply industry in general, formed the theme of the address delivered by Mr. W. Fennell (Mid-Cheshire Electricity Supply Co., Ltd.) as chairman of the North-Western Centre of the INSTITUTION OF ELECTRICAL ENGINEERS at Manchester on October 18th.

They were all proud of the position the I.E.E. had attained, he said, but from time to time there were grumbles. For instance, the public (meaning the employer) persisted in ignoring graduates when advertising for assistants. They were thus excluded from the type of responsible position which would give them the minimum two years' experience necessary for transfer to associate membership. The way to advancement was almost closed to them and the result was an appreciable number of resignations of graduates, creating a growing body of technically qualified men outside the I.E.E. membership.

In Mr. Fennell's opinion the public would not change its attitude, but he suggested that the difficulty that had arisen, which centred upon the interpretation of the word "responsible" in relation to "experience," was not insuperable. He expressed the hope that a more lenient definition approximating to that customary in dictionaries would go far toward removing the present difficulty.

Mr. Fennell also referred to the procedure of nomination for election to the Council, and suggested that encouragement by the Council of nomination by corporate members generally would be within the constitution and remove the present feeling that such nominations were not welcome.

The success of the local Centres was evident, but at the section meetings (Meters, Transmission and Wireless) there was a relatively negligible attendance of provincial members. The obvious remedy in this case was the formation of branch sections at local Centres.

One could not withhold admiration for the I.E.E. Wiring Regulations as an all-embracing code, but was it really advisable to have one complex set of rules which spread the impression that a simple domestic or shop-lighting installation with a few plugs, a wireless set and a radiator or two was so potentially dangerous that it needed so many precautions? In Mr. Fennell's opinion a reduction of 25 per cent. could be made in the cost of domestic installations without increased risk, and it must be made if a high rate of development was to be maintained. Simplification of design and a reduction of overhead costs by overhauling sales organisations were needed. Sales methods should not cost the consumer from 20 to 50 per cent. of the retail price of an article.

The prime costs of cables and accessories needed further consideration. The full E.R.A. rating should now be allowed in the I.E.E. Wiring Regulations. The recent insistance upon standard conductors for all but the smallest wire should be abandoned and solid wire permitted up to single 16 SWG for non-drawn-in systems. Means should be devised for reducing the labour involved in wiring and lessening the time absorbed in the "fiddling" work of connecting terminals and fixing accessories.

Plug-sockets and switches were too large, conspicuous and costly. Switches for single lamps, or small groups, need not carry and be required to break more than 1A; bakelite bases should be so made as to render wood base blocks unnecessary and one point (centre) fixing should be the rule for all small accessories, except wall plugs. Radiators and irons were relatively cheap, electric washboilers cost substantially more than similar looking gas boilers, while refrigerators and washing machines cost about twice what one would expect, due partly to the small output per maker, which meant that there were too many makers; for the same reason cookers were still too costly.

The prime cost of the smaller accessories, lamps and their holders, adaptors, plugs, etc., appeared to be low, but distribution costs were too high. The public was rapidly changing over from the "electric shop" to the chain stores, to the latter's great financial benefit. This was regrettable, but natural; also it was a sign that electricity supply had really reached the "near poor," who could not or would not pay the prices demanded by the electrical industry. The prices paid by chain stores could be obtainable by contractors through bulk-buying schemes. Here was a fruitful field for enterprise on the part of the Electrical Contractors' Association.

The prompt adoption by all undertakings of a standardised two-part domestic tariff was worth while. Compulsory changeover from DC to AC was a case, similar to that of frequency unification, in which it would not be fair to penalise the undertaking and/or its consumers merely to secure uniformity; given an indemnity, the change would be a desirable one. There was a strong case for an indemnity for voltage standardisation, which would be worth to the community the amount it would cost to carry it out equitably.

Reorganisation of areas would not automatically bring about

Standardisation and Lower Costs
Trolley Bus Operation
"Cramming" v. Education

Training for Industry. (*Continued from preceding page*)

practical use. The field in which the physicist now works has developed in such a manner that he often needs for his researches plant of great engineering magnitude. On this account, as well as for other reasons, it is probable that the great manufacturing organisations will undertake more and more fundamental research, as well as increase their research activities of a more specifically applied character.

A pleasing feature in the last decade has been the tendency towards co-operative research whereby problems of common interest to a large number of different organisations in the same industry are pooled. Given a number of materials, the engineer can be relied upon to devise means of deciding upon their relative suitability for specific purposes, but the time has arrived when he would like to visualise the possibility of "designing" materials for these purposes on a scientific basis without recourse to the "hit-or-miss" procedure. Because the problems involved are of extreme difficulty they demand the closest possible co-operation between workers in all the branches of science involved.

The continual accumulation and application of new scientific knowledge has exercised a profound influence on our communal life. It has placed at the disposal of mankind goods and services which men are not yet able to utilise or control to full advantage, and it has produced, or at least exaggerated, many social problems. These and the more immediate problems of the profession are the concern of the Institution. It is the responsibility of this generation to pass on with undiminished prestige the heritage handed down to it. Not the least important phase of this responsibility is that concerned with the education and training of those who will be its future members and on whom will ultimately fall the onus of leadership.

The ruthless efficiency and the direct and speedy action of the totalitarian states in matters concerning social, economic, and industrial affairs, attained at the expense of individual initiative, may be purchased at a very high price, but the challenge can only be met in a country like ours by such effective voluntary co-ordination as will secure the major benefits of a united front, with the added advantage of the preservation, in a large measure, of freedom of initiative and individual enterprise.

Already in our industry, says Dr. Fleming, we have had experience of the benefits of such voluntary co-ordination as in the British Electrical and Allied Manufacturers' Association and the Electrical Research Association, to quote only two examples, and much might be accomplished by a more complete consciousness of this principle. In this connection, the problem of education and training justifies careful consideration.

To a considerable extent the manufacturing companies are best adapted to provide the preliminary practical training for recruits for other branches of the industry. In this matter of practical training of all grades of workers, however, there is a very large disparity between the facilities provided by the different manufacturing organisations, and the resources of the industry are by no means adequately used in equipping in the best possible manner the young personnel on which the industry will eventually depend. A few concerns have undertaken the problem seriously. Co-ordination between the large firms and groups of specialist firms which possess the facilities for suitable training should not be impossible. The result would be to raise the technical level of the industry, which would react in improved trade, particularly overseas trade, from which all would gain.

standardisation, which would have to be bought and paid for. It was not possible any longer to consider amalgamations merely on a basis of engineering and economics. The present was a suitable time to publish alternative and more peaceful proposals, and to that end Mr. Fennell recalled the suggestions which he made in 1935 that the Electricity Commissioners could act with the advice of area joint (advisory) distribution authorities, which could be formed under the 1919 and 1926 Acts, and be similar in constitution to the South-East Lancashire Advisory Board which functioned with marked success prior to C.E.B. grid operation. Such an authority would be formed on a group basis of representation to ensure that all undertakings were well represented, but that none could dominate. There would also be representation of local authorities not owning undertakings, to represent consumers, and corresponding engineers' committees.

The principal duty would be to urge, advise and encourage owners of undertakings to bring about improvements in, and the standardisation of, their systems, tariffs, wiring methods and publicity. When necessary they would report to the Electricity Commissioners cases in which, in the opinion of the authorities, undertakings were financially too weak, or unreasonably declined to implement the advice given. The Commissioners would be empowered to deal with such cases, after holding an inquiry, and in extreme cases recommend to Parliament, through the Minister of Transport, that such undertakings be transferred by purchase on a "then value" basis to the local authority or a neighbouring undertaking.

Trolley Bus Considerations

AT a meeting of the London Local Technical Group of the ELECTRICAL POWER ENGINEERS' ASSOCIATION on October 18th, Mr. J. H. Parker (London Passenger Transport Board) lectured on "Problems on Trolley Bus Systems." At the outset, Mr. Parker stated the case for the trolley bus in preference to petrol or oil buses, as the best vehicle for superseding tramways. He added that he served on the Trolley Bus Committee of the British Electrical Development Association and was surprised to read the reports of transport managers in different parts of the country in favour of oil or petrol buses as against trolley buses. Taking everything into consideration, Mr. Parker claimed that the trolley bus was the cheapest vehicle to run and earned the biggest revenue. Too many transport authorities were so obsessed with oil buses that they did not give sufficient thought to the trolley bus.

Dealing with overhead construction problems, he said that in a city like London, where the streets were filled with pipes and cables, it was not easy to find room for some 20,000 poles and there had been a great deal of anxiety in this connection during the past three years. Concrete poles had been tried but, contrary to expectation, they were far too flexible and, strength for strength, were bigger than steel poles. It was no good using tramway overhead fittings in which the relative positions of vehicle and overhead gear were fixed, and it had been necessary to re-design existing fittings to suit the new conditions of a free vehicle and a shoe collector. To ensure that the ears were practically of even height and suspended in a vertical plane, a twin hanger had been evolved with an upward bend at one end and a downward bend at the other, so that when suspended in a sagging span the solid connecting bar would lie in a horizontal position. An electrically operated frog now in use was the result of eighteen months' intensive experiment and was very satisfactory. It was actuated by a push button on the pole at the bus stopping place so that the conductor did not need to hold the pull wire until the bus was through the frog and then race after the vehicle. The push button not only actuated the frog and moved it into a locked position, but it also actuated a lamp indicator to show the driver how the frog was set. Gunmetal shoes with carbon inserts had a life of about 1,000 miles.

Earthed and Insulated Systems

Mr. Parker then discussed earthed *versus* insulated systems and specially asked for views on that matter. Those substations which fed trolley buses only were run "all insulated," without tying the negative side to earth potential. If either wire now fell to the ground it was equivalent to earthing the fallen wire, and the other wire, left in the air, immediately assumed a potential of 600 V above or below the earth potential, but as it was in the air, no harm was done.

Another necessity was that the feeder circuit-breaker must be set sufficiently low to protect the wire from overheating. In London they fed each mile of overhead wire with its own pair of feeders, either 0.4 or 0.6 sq. in., protected by a high-speed circuit-breaker on the positive side, and an interlocked contactor on the negative side. Current was fed into the mid-point of the half-mile section in heavily loaded areas, and into one end of the section on other areas. In the case of the Victoria Embankment, where the traffic was so dense that there might be a string of buses half a mile long, the circuit breakers would have to be set so high that the overhead wire would not be protected. One solution would be to divide the overhead wire into smaller sections than the half-mile lengths required by the Minister of Transport, and feed each quarter or third of a mile with its own pair of feeders. But there were no sites to be had on the Embankment for additional sub-stations so the cost of feeders would be prohibitive.

An alternative was to run alongside the route a pair of heavy feeders protected at the sub-station by a circuit-breaker set at a high value, and to tee off to feed each quarter-mile of independent section of overhead line, each teed-off feed to a quarter-mile section passing through a feeder pillar carrying a circuit breaker and contactor set to protect that section. A special circuit-breaker suitable for enclosure in a normal sized feeder pillar had given very promising results. This method could be used to overcome another difficulty. For example, if both overhead wires were brought down on to the metal roof of a bus, the resulting short circuit might not be sufficient to bring out the distant circuit-breaker, and a local circuit-breaker in a near-by pillar would be the lesser of two evils.

Circuit-breaker Re-closing

With automatic rectifier sub-stations every two miles, each half mile of track was fed by a separate pair of feeders with contactors on the negative side and protected on the positive side by high-speed circuit-breakers of the automatic re-close type. The re-close intervals adopted by the Board were 10 seconds, 10 seconds, one minute and two minutes. It was necessary to re-close quickly before the buses had had time to slow down, and thus prevent re-closing on a slowing motor with the starting resistance still cut out. The interval of two minutes was for disentanglement of the booms from the overhead wire before the circuit-breaker attempted to re-close for the last time. This spacing out of the time had saved a lot of trouble. At the track end of each pair of cables two push buttons were installed in the feeder pillar. The "stop" button, when depressed, could be held down with a catch; the circuit-breaker was then kept locked and could not be replaced by hand even at the sub-station. In this way the traffic or electrical staff could cut off the supply and keep it off without leaving the half mile route. When the trouble was cleared, the circuit-breaker was re-set by releasing the catch and depressing the "start" button.

Consideration was being given to the design of a turntable, complete with overhead gear mounted on it, to avoid the handling of the trolley booms for quick turning at an awkward terminus. In London the average number of trolley dewirements from all causes, including swerving off the route to avoid accidents, amounted to 3.074 per 10,000 car-miles in August and 2.927 for September this year.

Discussion

In opening the discussion, Mr. W. J. Oswald, the chairman, said the case for trolley buses in substitution for tramways was unanswerable on the grounds put forward by Mr. Parker, while Mr. L. H. Short remarked that people came to this country from the United States, Canada, the Continent and elsewhere to study trolley buses. The main installations in Montreal were British and within the last few days the city of Edmonton (Canada) had ordered vehicles in this country. Australia, which had been susceptible to American influence, now had trolley bus installations of British design in Sydney, Adelaide, Perth and Hobart (Tasmania). London now had a trolley bus system which was showing the way to other operators, and had proved itself to be the best form of road passenger transport in substitution for tramways for city traffic.

But development was being handicapped by the high charges for electricity, which in some cases was 1.5d. per kWh, and this had often resulted in oil and petrol buses being adopted. Notwithstanding the high rate of acceleration to-day, he suggested the desirability of installing still larger motors and, perhaps, some means of automatic acceleration of 3.5 or 4 miles per second. Mr. Parker agreed on the question of acceleration and said that although high charges were made for electricity in some places, the cost of energy was only about 1/10th of the total operating costs.

Mr. J. L. North, speaking on regenerative control, suggested that instead of the complicated set of relays and valves in the rectifier sub-stations used by the London Passenger Transport Board, there should be merely a small rectifier bulb used as a regenerator, as in Liége. Mr. Parker said that that system had not been adopted in London because it would effect no saving in that area.

Mr. A. Lunn severely criticised electrical engineers for not giving more attention to the load to be obtained from trolley

buses. He contended that too much attention was being paid to getting irons, heaters and cookers on the mains when all the time this very considerable load was waiting if only steps were taken to secure it.

In reply to Mr. J. Parr Morley, Mr. Parker said that the trolley bus system could be made adequate to meet all present requirements and he believed an overhead system could be developed which would be absolutely satisfactory anywhere, apart from substitution on existing tramway routes. A chassisless vehicle was now being constructed that would enable a little weight to be saved for town and inter-urban traffic.

Mr. G. M. S. Sichel said that the correct type of overload protection was not instantaneous, but one of the thermal type. He asked if the extra weight of the battery for manœuvring was justified. Mr. Parker replied that the battery was meant for lighting, but the compound motor and battery in series enabled the vehicle to go for a mile at four miles an hour and so get away from a dead section. He was against interconnecting the DC side, because the idea was to isolate the sections in half miles and not the whole length.

Education and Character

DEVELOPMENT of the iron and steel industry, which he claimed constituted a fair background for the consideration of engineering progress generally, was the subject of the first half of the presidential address of Mr. David E. Roberts at the INSTITUTION OF MECHANICAL ENGINEERS in London on October 21st. Steel makers, he said, owed a great debt to the electrical manufacturers for providing them with reliable motors that could develop high power and yet be controlled and reversed with such extreme rapidity and ease; they were essential to the satisfactory running of large mills. In his judgment steelworks results were largely governed by the skill and attention of the management, or the want of it. Until very recently some works abroad were better equipped than some of our own, yet he had always felt that, due to wise management, our own manufacturers were in many cases able to produce unexpectedly good results with their indifferent equipment.

This led Mr. Roberts to comment in the second half of his address on the training of engineers. He stated that a very large Continental undertaking owning several steel works and employing 40,000 hands had maintained for many years a fine educational establishment which cost some thousands of pounds annually. But the men holding the important administrative positions in the works had shown no promise at all in the school, whereas nearly all those who had been brilliant in the school were holding only minor posts. The view was expressed that the latter, after being keyed up to take with credit their examinations and degrees, somehow ceased to develop thereafter. It was concluded that the best men developed late, were dull at school and could not be regarded as worth the cost of intensive "cramming"; thus they escaped this paralysing period without injury. The owners were now completely altering their plans.

This question was governed by individual conception of what the human mind really was. If it were something complex that only thrived upon what it absorbed by its own exertion and in its own time, then any kind of cramming might do great harm to a mentality not yet ripe for absorption. It would seem that all that educationalists could do was to lay all the jewels of their own superior knowledge before the student, so that when his mind was ripe for them he would gather them up. Mr. Roberts said he firmly believed that when this moment did arrive, the student acquired knowledge at great speed. Such a system might not be a great success as a means of passing examinations and taking degrees, but it would produce good, sound men.

The old system did inculcate something which later developed into the sturdy common sense and good judgment that fitted the engineer for management. Those early years in the shops trained the use of the normal faculties of observation and the ability to make rapid decisions and to know how to act in emergencies; moreover, they imparted the invaluable experience of constant contact with the workmen.

The New E.D.A. Films

MANY well-known electrical people were seen in the audience which gathered at the Cambridge Theatre, London, W.C.2, last Monday evening for the *premiere* of the three new films which have been produced by the British Electrical Development Association. The programme opened with a film made by Teddy Brown, the dexterous xylophonist, which proved quite a good introduction. This "jam" having been swallowed the first "pill" in the shape of a film "News by Wire" followed. It proved to be a pill which needed no jam but a "documentary" quite capable of being absorbed without nausea by the public whether electrically minded or not. It makes a rapid survey of electricity's manifold services to industry, agriculture, in the home and in the streets, and is accompanied by a commentary by Norman Shelley, which fortunately avoids the facetiousness with which such films are too often overladen. The grid is "put over" well and the photography is excellent.

A tour of a very different kind, "Hollywood To-day," was the next item, and one calculated to appeal to all women we think—and most men. Then came the second E.D.A. production, "The Proof of the Pudding." This is a trifle more pill-like, being a straight "sales effort." The way in which the correct use of the electric cooker is demonstrated is most telling and useful, although, we think, the demonstrator (Ruth Dunning) need not have been quite so serious, which applies also to her supporters, Renee Gadd and Betty Shale. We did not see enough of the little girl, Valerie Moon.

An excellent scenic film "Scotland" followed, in which John Watt comments on a remarkable series of photographs of places of historic and tourist interest. The third E.D.A. film—"The Good Old Days"—is the story of a man (Jerry Verno) who wished himself back in the 18th century and through the agency of "I'm Electric" found himself there and rapidly regretted it. Although rather farcical in character, the film is not a bad satire on the pampered modern who recalls with longing the airs and graces of our ancestors and forgets the discomforts which they endured in all directions.

We should mention that the directors of the three E.D.A. films were T. R. Thumwood, Montgomery Tully and Ralph Smart.

The verdict of last Monday's audience, which was not an unduly impressionable one, was that the films were a great success. The charges which E.D.A. is making for them should not be grudged by the most economically-minded committeeman or supply company director—they are good value for the money.

Two "stills" from the new E.D.A. films. Left: The kitchen staff (18th century) prepare water for a bath ("The Good Old Days"). Right: Electrical luxury ("News by Wire") Further pictures appear on page 628

Correspondence

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions

Motor or Trolley-buses?

I HAVE followed with much interest the arguments for and against the substitution of motor buses and trolley-buses for tramways in Manchester, as I am at present dealing with the same question in Port-of-Spain. The tramways here have served the public for upwards of thirty years and are now approaching the end of their useful life. Conditions here are different from those prevailing in England inasmuch as this is an oil producing country, and the utilisation of locally produced coal as opposed to imported fuel does not apply. The loss of the tramway load owing to the substitution of motor buses, however, would reflect unfavourably upon the load factor of the generating plant which supplies light and power for domestic and industrial purposes as well as for the operation of the tramways.

It is many years now since I introduced the first trolley-buses into Malaya when the Penang Municipality was faced with the same problem, and at one time I operated tramways, motor buses and trolley-buses simultaneously, but the final decision was in favour of trolley-buses, of which there is now a large fleet in successful operation. This problem, therefore, is not altogether new to me but I must confess that the capital cost of installing trolley-buses is rather staggering. It is difficult to understand why their cost should be so high compared with that of motor buses, bearing in mind the fact that an electric motor is kinder to a chassis in every way than a petrol or heavy oil engine. I cannot help but feel that the cost of trolley-buses could and should be very materially reduced by the manufacturers, and I have no hesitation in stating that the manufacturers would benefit by a very large increase in their turnover through the more universal adoption of trolley-buses.

Some years ago when I was home on leave from the East I was staying at Whitley Bay when motor buses were being introduced to replace the tramways, and I was rash enough to write to a local newspaper pointing out the irony of adopting motor buses to the detriment of the coal industry when they depended to a large extent upon the hewers of coal and others connected with that industry for their support. The newspaper did not publish my letter and as I was only on a visit to the old country I was not in a position to pursue the matter any further.

W. J. WILLIAMS,
General Manager,
Trinidad Electricity Board.

Port-of-Spain, Trinidad, B.W.I., *October 8th*.

Coal and Electricity

I appreciate your editorial note in the ELECTRICAL REVIEW of October 14th on the Coal Utilisation Council's co-operation with E.D.A. in securing either the retention of trams or, where trams are being scrapped, the introduction of trolley-buses. There are other forms of electricity utilisation in which we are working closely, amicably and profitably with the electrical industry.

You may take it that we regard it as our duty wherever possible to protect and encourage your industry. It is obviously in the interests of my Council to co-operate in maintaining and increasing the consumption of electricity in this country, especially in competition with imported fuel.

MATTHEW ANDERSON,
Director
Coal Utilisation Council.

London, S.W.1, *October 19th*.

The Price of Electricity

On page 473 of your issue of October 7th you have a leading article on "Fostering Good Relations." I should like to call your attention to the third paragraph where you say that a cheap and constant supply is generally catered for, and state that it is a fact that 97 per cent. of the consumers can obtain electricity at 1d. per kWh or less, over 80 per cent. at ¾d. or less, and over 60 per cent. at ½d. or less.

This statement, to me, is absolutely staggering. On my premises here I pay 4½d. per kWh for lighting and 2½d. per kWh for power. At home, a few miles away, I pay, I think, 4½d. for lighting and 1½d. for power.

The only people that I know of who get current at the price you mention, are either those who use a vast quantity and make a bargain with the suppliers whereby they get the figure down to something less than, or about the same as, they could generate it themselves; or alternatively, they pay, perhaps, £8 or £10 a year as a fixed charge, and then ½d. per kWh. But unless you are doing everything by electricity and so using a very considerable quantity, it will still work out at a pretty stiff price per kWh.

It seems to me that in a responsible journal such as yours, unqualified statements such as this third paragraph makes ought not to be made, as to say the least of it it is very misleading.

W. O. ANDREWS.

Salford, *October 19th*.

[We refer to this matter in a leaderette.—EDS., ELEC. REV.]

Wayleaves

The sweeping generalisation in the article entitled "Overhead Line Routes," included in your issue of October 14th, that the "increasing unwillingness of landowners . . . to grant wayleave facilities is due to . . . past errors in surveying routes" can hardly be allowed to pass unchallenged. While this may be obvious to your contributor who presumably has had some dealing with wayleaves, there are other aspects of the matter which are equally or more to blame.

The foremost past and present error made by supply undertakings in my opinion is that of offering ridiculously small wayleave rentals. The farmer of to-day has to be something of a business man in order to deal with the paper work of the various marketing boards, and to ask him to accept 1s. per annum for the nuisance of a pole on his property is really an implied insult to his sense of values, and to his own valuation of his time. As if this were not enough, the authority must wrap up the agreement in the form of a complicated quasi-legal document (which really calls for the services of a lawyer to see that the farmer's interests are protected), and this is fired at the landowner through the post accompanied by a stereotyped letter; after which the wayleave officer will wait for the gifts of Providence to tumble into his lap. Should they not materialise, supposing the farmer to be "stubborn" or "avaricious," there is always the big stick of the M.O.T.

Finally, we have the supreme irritation—that of the farmer, having been reared on the post-war "grid" propaganda of cheap electricity for all, being invited to accommodate the electricity undertaking by accepting a line of poles across his land, and then being informed perhaps a little patronisingly that the voltage is quite unsuitable to supply his milking machine or light his farmhouse.

The pressing need of the future is not more accurate surveys (to me, as a surveyor, there are obvious criticisms to the proposals which Mr. Gaved puts forward on this score) but a more enlightened psychology in the method of preparation and presentation of wayleave agreements, and as this must come sooner or later, it may as well be sooner.

DANIEL.

October 18th.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, November 3rd. Institution, London, W.C.2. 6 p.m. Ordinary meeting. "The Mechanism of the Long Spark," by Dr. T. E. Allibone.

Transmission Section.—Wednesday, November 2nd. Criterion Restaurant, Piccadilly, W.1. 8 p.m. Conversazione and dance.

Wireless Section.—Wednesday, November 2nd. Institution, London, W.C.2. 6 p.m. Chairman's inaugural address by Mr. A. J. Gill.

Meter and Instrument Section.—Friday, November 4th. Institution, London, W.C.2. 7 p.m. Chairman's inaugural address by Capt. B. S. Cohen. "Protective Devices for Telecommunication Purposes."

North-Western Centre.—Tuesday, November 1st. Engineers' Club, Manchester. 7.15 p.m. "High-speed Protection as an Aid to Maintaining Electric Service following System Short Circuits." by Messrs. T. W. Ross and C. Ryder.

Tees-side Sub-Centre.—Wednesday, November 2nd. Cleveland Technical Institute, Middlesbrough. 6.45 p.m. Address by Mr. F. A. Orchard (chairman of the North-Eastern Centre).

Association of Mining Electrical Engineers (*Lothians Branch*).—Saturday, October 29th. "Research in the Development of Flameproof Electrical Enclosures," by Dr. C. S. W. Grice.

South Wales Branch.—Saturday, November 5th. Demonstration of cable jointing.

Institution of Civil Engineers.—Tuesday, November 1st. Great George Street, Westminster, S.W.1. 6 p.m. Presidential address by Mr. W. J. E. Binnie.

Electrical Power Engineers' Association (*London Local Group*).—Tuesday, November 1st. Caxton Hall, Westminster, S.W.1. 7.15 p.m. "Ripple Control," by Mr. H. Purslove Barker.

Institution of Heating and Ventilating Engineers.—Wednesday, November 2nd. Institution of Mechanical Engineers, Storey's Gate, S.W.1. 7 p.m. "Air Conditioning Requirements of Cinemas," by Mr. L. W. J. Henton.

Institution of Mechanical Engineers.—Friday, November 4th. Storey's Gate, Westminster, S.W.1. 6 p.m. Thomas Hawksley lecture. "The Development of Television," by Sir Noel Ashbridge.

New Electrical Products

A review of equipment recently marketed

Air Raid Refuge Lamp

The "Nife" type "R" emergency lamp

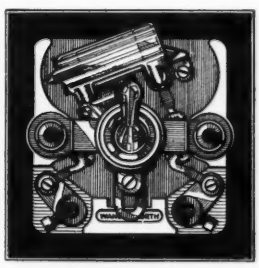
THE "Nife" type "R" lamp has been designed for lighting in domestic refuge rooms and all places where, under emergency conditions, an all-round light is needed.

The lamp employs a rechargeable all-steel accumulator which provides eleven hours continuous light on one charge and is of the type which is used in miners' lamps. The lamp has a ribbed well-glass fitting. As it is intended for use in a room and not as a hand-lamp a switch is not necessary. To obtain light the battery is inserted in the polished wooden box with the terminals towards the front, and when the lid is closed down the lamp will remain alight as long as the fastener is in position. When the fastener is released the lid springs up automatically.

The type "R" is one of a range of lamps designed for A.R.P. by Batteries, Ltd., Hunt End Works, Redditch.

Mercury Tumbler Switches

For places where explosive gas is used, such as in operating theatres, maternity wards and dental clinics, the Wandsworth Electrical Manufacturing Co., Ltd., Imperial Works, Kenyon Street, Birmingham, 18, has brought out a mercury switch with an ordinary switch dolly action. Should it be found necessary to renew the tubes,



The Wandsworth mercury switch

which incidentally are porcelain lined, all that is necessary is the removal of three screws. The dimensions are about the same as in an ordinary tumbler switch, the porcelain base measuring 2⅛ in. by 2 in., the outside dimensions of the boxes being 3¼ in. square. Two types are available, 2⅛ in. and 1⅜ in. deep. The operation of the switch is, of course, silent, and the rating is 5 A (single-pole). Double-pole switches are shortly to be made available.

Electric Door Chimes

The "Rittenhouse" door chimes which are being sold in this country by Tridecon, Lincoln Chambers, Portsmouth Street, London, W.C.2, are made in several models. The "Twin-tone" chime strikes two separate harmonising notes. A double duty version has one signal with the two notes given in succession and a second signal with the notes given in unison so that calls from the front and back doors of the house can be distinguished. A "Junior" design with a single note is also available. The "President" model is 40 in. long and has a pipe organ tone. It operates on a 14-V bell transformer giving 10-12 W or a 6-8-V dry battery, while the other model operates on a 4½-V dry battery or an 8-V bell transformer. In addition there are three "Softone" designs with single note or double harmonising note.

Slow-break Flat Pin Switch-sockets

G. H. Scholes & Co., Ltd., Wythenshawe, Manchester, have commenced manufacturing a new "Wylex" switched socket outlet which has unusual features.

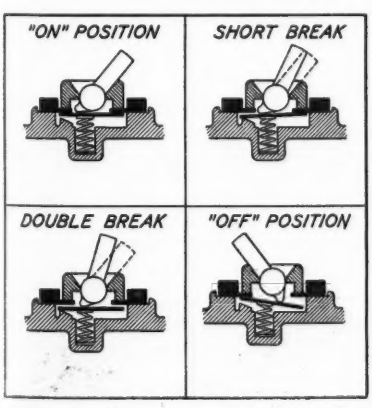
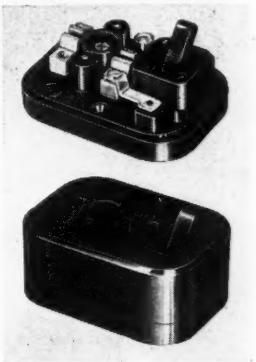


Diagram of the slow-break switch showing "on," short break, double break and "off" positions

It incorporates the flat pin plug and socket principle with a slow short break switch. A short break is not suitable for the final "off" position, and a long break in this position has been achieved in a novel manner. Referring to the diagram, it will be seen that contact is made by a substantial flat plate which, in the "on" position, is kept against the contacts by means of a spring. The action, as shown in the second sketch, is that the dolly causes the plate to move on one side only, this movement being a slow one not controlled by any spring or toggle. On moving the dolly further the motion changes to the other side of the plate, and here a long break is obtained, giving the final "off" position.



The "Wylex" switch-socket

The result of this new principle in switches is that an exceptionally small and neat unit has been produced. The normal rating is 15 A, and the mechanism is no larger than that of most 5-A switches. There are only two moving parts, the dolly and the contact bar, and the robust control spring has a direct compressive action. Silver contacts have been chosen, it is stated, because it has been found by experience that they improve with use.

The makers have been experimenting with this new switch for some considerable time, and interesting tests were carried out by an independent authority.

For the current capacity test a load of 30 A, AC, was connected, and continuous tests were made, both making and breaking quickly and slowly, and also with idle periods in between the tests. The switch was operated a thousand times and was not affected.

A life test was carried out with an actual AC load of 3 kW and the switch was operated by an automatic control arm working 47 times per minute. The number of operations during this test was 24,000 (complete makes and breaks) and a thorough examination showed that there were no apparent ill effects.

Temperature rise is important in a heavily loaded switch, and the maximum temperature rise on the contacts, after a 2½ hours' run, was 5.3 deg. C.

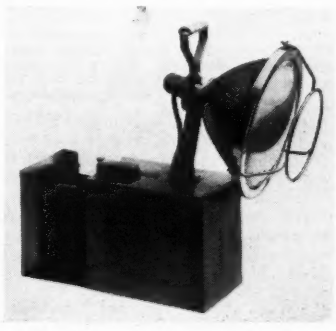
An Air Raid Warning Device

A device is about to be put on the market by Warren Brothers (Middlesbrough), Ltd., Prudential Chambers, Middlesbrough, for use as an air raid warning where the local authority decides that a warning is to be given by the interruption of the supply. This portable apparatus is so designed that when the primary supply is cut off it immediately puts into action a secondary low voltage supply and an audible and visual warning is given. The bell can then be switched off and the main supply disconnected, leaving the apparatus to be used as a light portable hand-lamp.

The Warren air raid warning and hand-lamp

A Portable Searchlight

A small self-contained portable searchlight operated from a non-splash "Exide" accumulator is the latest introduction by Goodliffe Electric Co., Ltd., Goodtric Works, Purley Way, Croydon. The lamp has an 18-W V-shaped filament. The searchlight is adjustable for practically any position, the diameter of the reflector being 7 in. The switch is suitable for permanent operation or for Morse tapping. The finish is dreadnought grey with chromium-plated fittings and the measurements are 14½ in. high by 8 in. wide by 11 in. long, and the weight complete is 20 lb.



The "Purley" portable searchlight

E

Emergency Supply Apparatus

In general, two systems of emergency supply by batteries are in operation, *viz.*, floating battery and change-over contactor, both of which depend upon the battery being kept in a fully-charged condition to provide the stand-by supply. The new emergency supply unit, of F. C. HEAYBERD & Co., 10, Finsbury Street, London, E.C.2, is designed to operate on both these systems.

The Heayberd emergency supply unit

The battery is maintained in a fully-charged condition by a small metal rectifier and transformer, which supplies a constant trickle charge. A much larger rectifier and transformer is incorporated to supply the load, and the occasional quick charge required after discharge takes place. For large installations, the rectifier is replaced by a valve rectifier and a delay switching device to allow the filament to reach correct operating temperature before the load is applied.

The equipment incorporates a red signal lamp to indicate failure of supply, a green lamp to indicate that the load is "on," and an amber lamp to indicate that the battery is discharging. Visual indication of circuit conditions is provided for by means of a moving-coil centre zero ammeter, moving coil milliammeter and moving coil voltmeter. All switch escutcheons are clearly engraved making reference to instructions unnecessary.

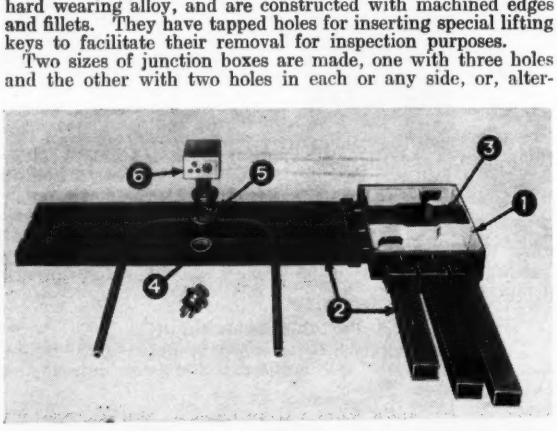
An Under-floor Metal Duct System

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has marketed an under-floor metal duct system, complying with B.S.S. No. 774, 1938.

Earth continuity has received primary consideration and is ensured by joining together each length of duct by malleable iron sockets into which the ducts are butted and fixed with steel cotter pins which, when driven home, make a metal-to-metal joint for bonding. The same principle is adopted with the connections to the junction boxes, and other accessories.

The duct employed is made in a standard length of 15 ft. of 2 in. by 1¼ in. heavy gauge steel and, if required, holes of 1¾-in. diameter are provided at predetermined intervals for connecting various fittings to enable floor connections in the form of standpipes, &c., to be attached. Junction boxes are supplied in cast-iron and equipped with floor traps made from a hard wearing alloy, and are constructed with machined edges and fillets. They have tapped holes for inserting special lifting keys to facilitate their removal for inspection purposes.

Two sizes of junction boxes are made, one with three holes and the other with two holes in each or any side, or, alternatively, they can be supplied undrilled. The ducts are joined to the boxes by adaptors of malleable iron, and a small degree of flexibility allows for any slight inequality in alignment due to the rough floor surface.



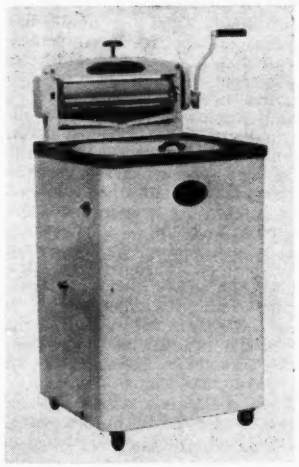
The G.E.C. under-floor duct system
(1) Junction box; (2) 1¼ x 2 in. rectangular duct; (3) intersector; (4) stamped cover; (5) B.S. connection for conduit; (6) stand pipe unit with lighting switch socket.

Intersectors for both two- and three-way boxes separate the high- and low-voltage services and accord with the I.E.E. Regulations. They are bonded to the boxes by special earthing screws. When outlets are required in the duct, a hole of 1¾-in. diameter is made, which allows any of the adaptors and standpipes to be connected without tapping or cutting. If the holes are not required immediately, they are closed with a pressed steel cover which snaps into position and is sealed with compound until needed.

Conduits can be run off the ducts by means of a special type of conduit box which is fixed to the outlet hole by a malleable clip, and is supplied in the standard small B.S. size in all the usual types. Small traps are made for placing over openings covering unused outlets and conduit boxes.

Burco Washing Machine

Manufacture of a new washer, electrically driven but with a hand-operated wringer, has just been commenced by BURCO, LTD., Rose Grove, Burnley. The body is square with a circular tub finished in mottled grey enamel, and movement of the clothes is obtained by means of a three-vaned agitator. A steam-tight lid fits over the pan and is provided with a heat-insulated handle, and the pan is drained by means of a special hose pipe.

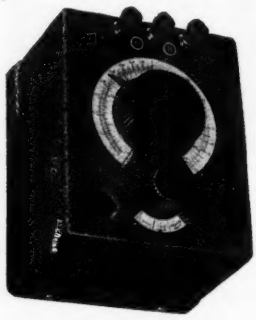


The new "Burco" washer

An extra is a strong metal table top finished in white vitreous enamel with a black band to match the cabinet. The 16-in wringer is easily fitted and has rubber rollers. The machine is mounted on three castors and has one adjustable leg. The dimensions are: height of cabinet, 34 in.; width and length, 22 in.; height to top of wringer when in use, 46 in.; diameter of tub, 20 in.; and depth of pan, 13 in. When not in use the ironing attachment is housed in the cabinet under the pan.

Compact Resistance Bridge

The dimensions of the bridge introduced by the MULLARD WIRELESS SERVICE CO., LTD., 225, Tottenham Court Road, London, W.1, for measuring resistance, determining the conductivity of solutions, locating faults in cables, &c., are 7 by 5.5 by 5.25 inches, and it weighs 6 lb. Type GM4140 consumes 11 W and is mains operated at from 100 to 250 V and from 40 to 10,000 cycles.



The Mullard measuring bridge

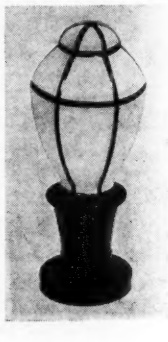
The balance indicator is a miniature electron beam tube working in conjunction with a high-gain pentode valve amplifier, the degree of sensitivity being continuously variable by means of a potentiometer. A cross of green fluorescence appears in the aperture, which contracts to the minimum width at the exact null-point. Since this device is of the cathode-ray type, it eliminates parallax errors, is entirely inertialess, and is unaffected by vibration.

The instrument has a wide range; both resistance and capacity measurements may be read directly from the scale, while inductance measurements may be made with the aid of external standards. A percentage scale is incorporated to enable rapid checks to be made between two resistances or condensers.

A switch position is provided that converts the circuit into an "open bridge" so that by placing external standards in one "arm" the range of the instrument is considerably increased. There is only one volt across the terminals, thus avoiding danger of shock. Short-circuiting the terminals will not damage the instrument and its metal case is provided with an earthing terminal.

The "Newelite" Staircase Fitting

For mounting on a staircase newel post the BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, London, W.C.2, has designed the "Newelite" fitting, although it can equally well be used as a ceiling light of unusual decorative character. An attractive "period" effect can be obtained by the use of several "Newelite" units on the ceiling of a panelled room. They consist of a newel lamp with a specially designed lampholder fitting, and are available in either parchment or flame finish with the moulded corners in black lacquer. The fitting itself is a dark brown moulding on the inside of which is provided a rubber gasket designed to hold the lamp rigid.



A "Mazda Newelite" fitting

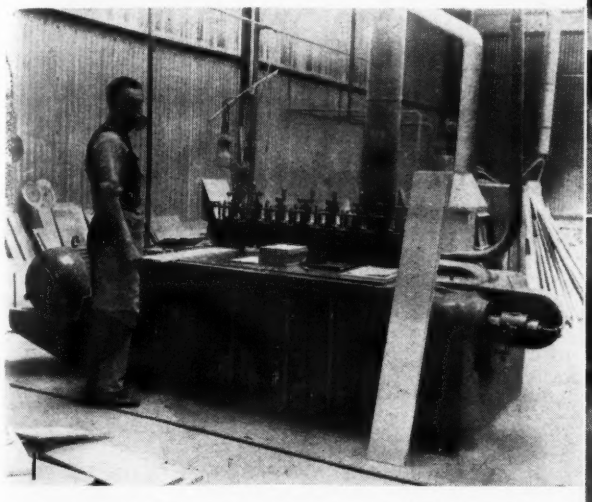
Making Insulating Materials

Processes at a Tyneside factory

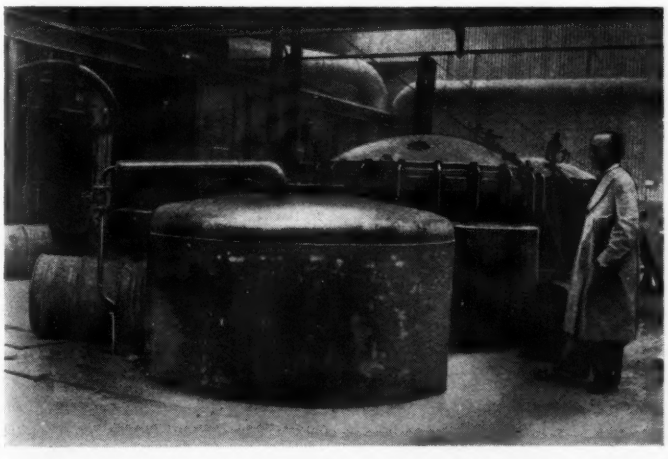
BY kind permission of Interohm Electrical Insulators, Ltd., we were recently able to learn something of the processes involved in the manufacture of asbestos-cement and mica insulating materials as they are carried out in the company's factory at Felling.

Asbestos cement sheet is the company's main product and, broadly, this is supplied in two forms—untreated, for such uses as arc shields, where it does not come into contact with live conductors, and impregnated, for such uses as switchboard panelling with directly attached live parts. By the introduction of colouring at the impregnation stage various shades of the material can be provided to suit customers' requirements, but Mr. F. Wythes, general manager, to whom we are indebted for help in compiling these notes, was careful to make it quite clear to us that to introduce colours to the material necessitates the use of hydro-carbons with resultant decreases in the arc-resistant properties of the material.

A feature of the unenamelled grade of sheet impregnated with light oils is its heat and arc-resisting qualities coupled with high electrical insulation. From a mechanical point of view its outstanding properties are great mechanical strength



and hardness in consequence of its compression during manufacture to 2½ tons per sq. in. This degree of hardness prevents the slackening of nuts or their sinking into the material with such consequent troubles as are experienced with some other types of sheet. The main raw materials are asbestos and cement and these and other ingredients are first mixed in a machine with interior revolving paddles something like the arrangement of a dough-mixing machine. A group drive for two of these mixing machines is a Holmes 20-HP motor with belt transmission to overhead shafting and

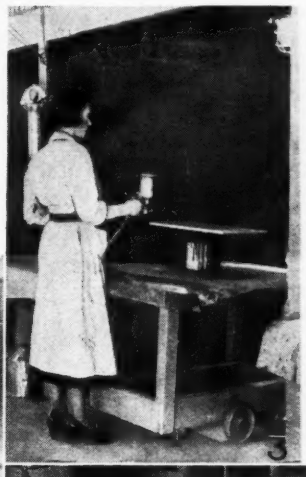


belt " drops " to fast and loose pulleys on the machines and final transmission through incorporated reducing gear. The motor is served by a star-delta starter.

The mixed material is fed down a shute to a trolley which introduces the mixture to a hydraulic press for treatment at an overall pressure of 5,000 tons, or from 1 to 2 tons per sq. in. Any required thickness of standard sheet up to 2 in. is produced in this way, and greater thicknesses can be made to order.

Serving this hydraulic plant *via* an accumulator there is in a pit a set of three-throw pumps driven by a 20-HP, 710-RPM slip-ring motor. This motor is of the enclosed ventilated type and is automatically controlled by trip-switches on the accumulator. A safety lever, also on the accumulator just above the trip-switch, automatically turns the water from the pump to waste in the event of a failure of the trip-switch to operate.

After maturing, a process the length of which varies according to the thickness of the sheet up to 60 days, the sheets are cleaned up on sanding machines and those that are to be used in the grey, *i.e.*, unimpregnated, are trimmed and sanded down to required thickness to an accuracy of ± 10 " thous." Two types of sanding machines are employed—belt sanders in which the work is held on a traverse table under the sanding belt while



Stages in the manufacture of asbestos sheet:—1. Machine for dry cutting out. 2. Rubbing down ready for spray painting. 3. One of the spray-painting booths [*Elec. Rev. photos.*

pressure is applied to the belt by a hand lever, and drum sanders in which the work is belt fed under revolving sanding drums. As an example of the driving arrangements, in the case of one of the double-drum sanders an 18-HP 960-RPM Crompton Parkinson motor drives the feeding belt and the two sanding rolls. There is also side-to-side movement of the rolls which is effected by a ratchet worked off the drum drive. With a line of machine tools a belt sander forms a group drive from a 10-HP motor.

Sheets to be impregnated are first placed in ovens to expel their moisture content, and they are then treated in impregnating vats. The sheets are drained to rid them of superfluous oil, after which they are baked out, for varying periods depending

A corner of the impregnating room [*Elec. Rev. photo.*

on the thickness of the sheet, at high temperatures. The sheets are then taken out of the ovens and cleaned and finished off for whichever grade of product is required. For example, the products are available in a plain polished finish, unenamelled, matt or bright cellulose, or stove enamelled.

In the enamelling department we saw girls busily engaged in rubbing down treated sheets with sand paper, thus making a surface ready for the next coat of paint. The sheets are thoroughly rubbed down before being passed to the paint-spraying department.

Mouldings to various shapes are also produced in asbestos cement material, in some cases from the initial mixture and in other cases after the oil has been introduced. Sometimes the addition of oil is necessary to create the essential " flow " to the mould. For the moulding of small parts, either cold or under heat, there are 75-ton hydraulic presses. The material

can be machined with the simplicity associated with woodworking, and in a well-equipped machining section one would imagine oneself in an up-to-date electrically driven joiners' shop, but for the presence of the material under treatment.

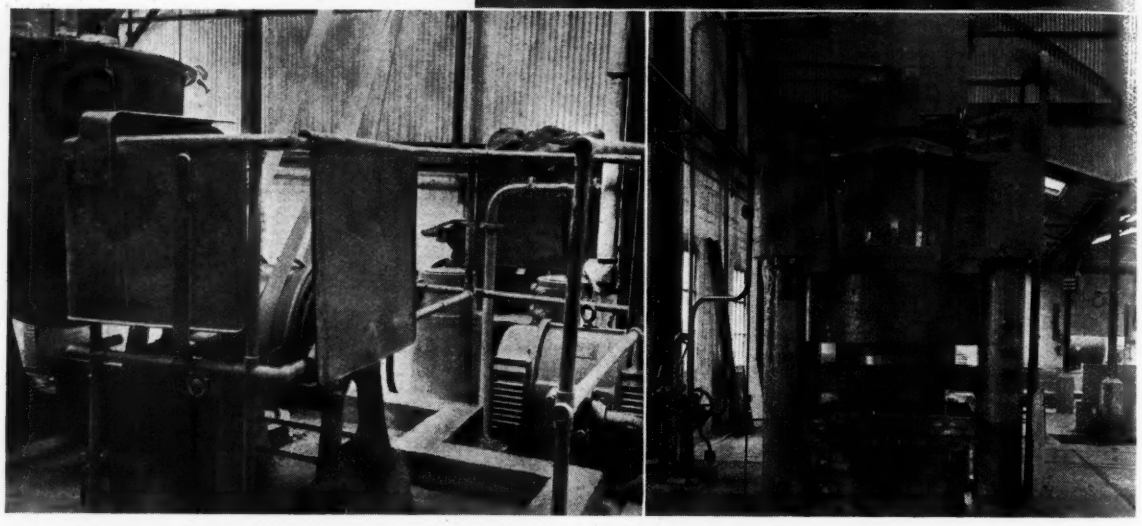
A special machine cutting out discs has a revolving table to which the material is secured and which carries the work against a band saw. A small incorporated motor drives both the table and the saw.

We saw at work both dry and wet cutting-out machines. The "dry" equipment will deal with sheets up to one inch in thickness and carborundum saw wheels are employed. One of these machines has a worm gear reduction drive from a 3-HP externally cooled B.T.H. motor, while a smaller motor drives a traverse feeding belt. The wet cutting-out machines deal with heavier sheets and the operating principle is similar to that of marble-cutting machines.

One of the double-drum sanding machines [*Elec. Rev. photo.*

Routine electrical tests are conducted on the impregnated sheet in the adjacent laboratories. A sample from each batch is tested under dry and humid conditions before enamelling for both volume and surface resistivity.

The mica products are principally flexible and moulding materials in various finishes, with cotton, silk and paper coverings. Mica splittings are the raw material for this section and they are laid out on a background of brown paper on long tables by girls who are adept at overlapping the splittings so as to achieve uniform thickness throughout. The laid-out splittings are dabbed with varnish so that they adhere in the form of a long sheet the length of the table. The sheets are then cut up into required lengths and dried in steam-heated ovens. The dried sheets are compressed into any required thicknesses in hydraulic presses similar to those used for the asbestos cement materials. We saw a 760-ton press and a dual-pressure equipment (250 and 500 tons) engaged on this work.



A group drive for two mixers, showing one of the machines and (right) a large hydraulic press [*Elec. Rev. photos.*

Municipal Trading at Eastbourne

THE matter of sales from the Eastbourne Corporation's Electricity showrooms is discussed in a report by Mr. J. K. Brydges. He points out that it is erroneous to regard the debit balance of £1,600 on the showroom accounts as a loss on the sale of fittings. Deducting the cost of demonstration and general service the actual deficit is reduced to £536. During the last financial year the 25 per cent. discount paid to local electrical contractors in respect of showroom sales was £1,089, and it would appear only equitable that the discount should not be handed over entirely to the contractors. "Should the sales be dispensed with entirely, this would only reduce the showroom staff by the equivalent of two, and it would appear, therefore, absurd not to make use of the showroom equipment and facilities for the purpose of sales, since many purchasers of fittings have, in the first instance, entered the showrooms in connection with some other matter."

Mr. Brydges maintains that the Department has a greater interest in keeping apparatus in order to ensure the continued use of electricity and "any restriction on behalf of a small section of the community is bound adversely to affect the interests of the whole of the ratepayers."

He regards the showrooms as a means of electrically educating the consumers and keeping them up to date. The propaganda activities of the showroom staff have resulted in direct business to the contractor in one form or another and "there is little doubt that contractors rely on the continued development of the undertaking." It is pointed out that of the thirty-eight local contractors only sixteen are members of the E.C.A. and only eight have shops or small showrooms. "There is no doubt that the remaining thirty, and some of those with shops for that matter, make good use of the showrooms, draw from our stock and save their own overhead charges. In fact, the majority need have little capital if they make full use of the showrooms."

With regard to the suggestion that the showrooms could be stocked by the contractors, Mr. Brydges says that this system was tried when the showrooms were first opened, but proved to be a failure due to disagreement between the contractors themselves and to the use of obsolete stock.

Apparatus must be demonstrated to be sold, and if the showrooms were not permitted to sell equipment it would soon depreciate and become obsolete with a loss to the undertaking while as much space as at present would still be required. Mr. Brydges stresses the need for spacious, well-laid-out showrooms, and concludes: "Competition between utility undertakers is keener to-day than ever before and every effort will be required in every branch of the undertaking to maintain progress. Whether they like it or not, they are in hourly competition with the Gas Co., which will certainly not curtail the activities of its showrooms nor reduce its existing floor space. Their methods must be on parallel lines."

Personal and Social

Information regarding new appointments and other matters of interest for this page are welcomed

DURING the last few days lighting experts from Holland, Hungary, Belgium, Germany, France, Switzerland and Sweden have held meetings in this country with the main purpose of interchanging experience and information on lighting development. Some of the delegates visited the Glasgow Exhibition and were much impressed with the spectacular lighting effects in the Government Pavilion. The delegates

Meeting of lighting experts held in the Committee Room of the E.L.M.A. Lighting Service Bureau. The visitors include Messrs. Pillitz (Hungary), Vink (Belgium), Heerbrant (Belgium), Kalff (Holland), Henke (Sweden), Folcker (Sweden), Atherton (Switzerland), Talhaber (Switzerland), Seeger (Germany), Chappat (France), and Dr. Geiss (Holland)

also visited Blackpool, the chairman switching on the illuminations on October 16th. The visitors were interested in the floodlighting of factories on the Great West Road, and noted the great strides that have been made in this country in street lighting. The meetings were held partly in the recently reconstructed Lighting Service Bureau and partly in Crown House, Aldwych.

Mr. T. E. Robinson, who has been the assistant engineer of the Petersfield Electric Light & Power Co. for three years, has been appointed commercial and technical assistant to the Colne Valley Electricity Supply Co., as from November 1st.

Mr. L. H. Finedon has terminated his employment with Graham Farish, Ltd., and has joined Morphy-Richards, Ltd., as assistant sales engineer.

Mr. R. W. L. Phillips, the retiring borough electrical engineer at Bedford, has been presented by the Town Council with an illuminated address and a silver salver.

Sir Edmund Davis has resigned from the boards of Turner & Newall, Ltd., and its subsidiary, Rhodesian & General Asbestos. He was chairman of the latter company.

Mr. A. T. Griffith, manager of the Middlesbrough branch of the General Electric Co., Ltd., has found it necessary to retire owing to ill-health. He went from the Newcastle branch to Middlesbrough in 1928 when the latter branch was opened, and altogether has served the company for twenty-nine years. His successor at Middlesbrough is **Mr. G. H. J. Sansom** who joined the G.E.C. in 1917, and after experience in London and at the Southampton, Cardiff and Newcastle branches, was transferred to Middlesbrough ten years ago. He is hon. treasurer of the Tees-side Committee of the E.I.B.A.

Mr. G. H. J. Sansom

Mr. A. J. Afford, constructional mains engineer with Manchester Corporation Electricity Department and previously mains assistant with Great Yarmouth Corporation Electricity Department, has been appointed mains engineer with the Kendal Corporation Electricity Department.

Dr. A. E. Kennelly has been elected honorary president of the International Electrotechnical Commission, according to the official organ of the American I.E.E. Dr. Kennelly, who is professor emeritus of electrical engineering at Harvard University, and the Massachusetts Institute of Technology, received his early education in private schools in Europe. He was awarded the honorary degree of Doctor of Science by the University of Pittsburgh in 1895, and by the University of Toulouse, France, in 1922, and received the honorary degree of Master of Arts from Harvard University in 1906. In 1875 he became assistant secretary of the Institution of Electrical Engineers (Great Britain), and after holding various other positions he went to the United States in 1887, and was engaged as principal electrical assistant to Thomas A. Edison until 1894. In that year he became associated with Edwin J. Houston in the firm of Houston and Kennelly. He was appointed professor of electrical engineering at Harvard University in 1902, and continued in that position until he retired from active service in 1930. From 1913 until 1924 he was professor of electrical engineering at Massachusetts Institute of Technology, and for some years was director of electrical engineering research and chairman of the faculty of that institution. Dr. Kennelly served as a United States delegate to the International Electrical Congresses in Paris (1900) and St. Louis (1904), and the International Radio Conferences in Paris (1921) and Washington (1927). He is also honorary president of the United States National Committee of the International Electrotechnical Commission.

Mr. E. Porter, who joined the Leeds Corporation Electricity Department in 1899, will retire from his post as assistant electrical engineer in January next, on reaching the age limit.

Mr. F. G. C. Baldwin, O.B.E., M.I.E.E., Chief Engineer, North Eastern Region, G.P.O., Leeds, who is to retire next month, was responsible for the conversion of the Newcastle and district manual exchanges to the automatic system during the five years until 1935 when he was superintendent engineer at Newcastle. Mr. Baldwin, who was born at Sheffield sixty years ago, started his career as a draughtsman with the National Telephone Co. at the age of seventeen. In three years he became the company's engineer at Sheffield. In 1906 he was promoted to district engineer at Birmingham, and in 1909 became assistant metropolitan engineer in London. He was appointed superintendent engineer for Newcastle and district in 1930. In his position at Leeds Mr. Baldwin has had control of an engineering staff of 4,000, responsible for 1,200,000 miles of underground and 165,000 miles of overhead lines in addition to 282,000 telephone stations served by 665 exchanges. Mr. Baldwin is the author of "The History of the Telephone in the United Kingdom," published in 1925, and of a paper read before the I.E.E. on "Telephone Exchanging Transfers," for which he was awarded the Fahie Premium.

[Lafayette
Mr. F. G. C. Baldwin

Mr. W. H. Cooke, borough electrical engineer at Luton, is retiring next year, and the Corporation is advertising in this issue for a successor.

The staff of the Birkenhead Electricity Department has made a presentation to **Mr. W. Richmond** (mechanical engineer) who has retired after forty-two years' service with the Electricity Department. Mr. Richmond, who held the record for the longest service with the department, went to Birkenhead in 1896 when the generating station at Bentinck Street was being built and was engaged in the erection of the first generating sets by the contractors, Crompton & Co., of Chelmsford. Since that time he has supervised the erection and maintenance of many extensions to the plant.

Mr. L. Wyton, who has been with the General Electric Co., Ltd., for the past fourteen years as an industrial heating and cooking specialist, has been appointed manager of the Industrial Cooking Department of the Simplex Electric Co., Ltd., and recently took up his new duties.

Mr. E. R. Hudson, of Ilkeston, was presented with a lounge chair in leather on October 24th by the members of the Midland Branch of the Association of Mining Electrical Engineers as a mark of their appreciation and in recognition of his services as honorary secretary of the branch for twenty-five years. The presentation was made by Mr. A. W. Williams (past president of the Association) at the annual supper of the branch held in Nottingham.

Mr. G. T. Allcock, B.Sc., A.M.I.E.E., A.M.I.C.E., who has been with Manchester Corporation Electricity Department for ten years, has been appointed deputy electrical engineer to St. Helens Corporation, and will take up his duties in the near future.

Mr. C. I. Robinson, B.Sc., M.Inst.C.E., a director of the Thames Electric Co., Ltd., has left London for Malaya, on business. He hopes to be back in March.

Mr. F. S. Turner terminates his engagement with Wm. Sanders & Co. (Wednesbury), Ltd., as London representative on October 29th. His duties will be taken over by **Mr. C. E. Coggins,** who is being transferred from the Midland area where he has represented the company for the past seven years.

Obituary

Mr. E. H. F. Reeves.—We regret to record the death of Mr. Edwin Herbert Francis Reeves at his home at Orpington on October 17th. Mr. Reeves was connected for the greater part of his business life with Crompton & Co., Ltd., of which company he was managing director for some years prior to its amalgamation with F. & A. Parkinson. He retired from the board of Crompton Parkinson in 1932. He was also a director of the Electric Supply Corporation, Ltd., the Hendon Electric Supply Co., Ltd., the Electric Construction Co., Ltd., the Settle and District Electricity Co., Ltd., the Telegraph Condenser Co., Ltd., and the Suffolk Iron Foundry (1920), Ltd.

Sir John Griffith, whose death occurred on October 21st at the age of ninety, was responsible for many engineering works. He was chairman of the Water Power Resources of Ireland Sub-committee appointed by the Board of Trade, and played an active part in the scheme for the utilisation of the River Liffey, for which the Dublin Corporation conferred on him the freedom of the city.

Mr. G. H. Thompson.—The funeral took place at Oystermouth Cemetery, Swansea, recently, of the late Mr. George H. Thompson, chief electrical engineer to the Neath Rural District Council. Mr. Thompson went to Swansea about thirty-five years ago.

Mr. R. A. R. Bolton.—We regret to announce that Mr. R. A. R. Bolton died at Hassocks, near Brighton, on October 19th, a few hours after being knocked down by a motor car. Mr. Bolton, who was born at Riga where his father was British Consul, received his early education at Helsingfors. He took a degree at Aachen, and completed his engineering training at Siemens-Schuckert's Nuremberg Works. He came to this country about forty years ago, and first served with the British Thomson-Houston Co., Ltd. He joined Siemens Bros. Dynamo Company in 1902, and subsequently the English Electric Co., Ltd., after the amalgamation. During this time he did considerable pioneer work on high-speed DC circuit-breakers and automatic sub-station control gear. He joined Allen West & Co., Ltd., in 1927, to develop a range of metal-clad switchgear, and retired in 1935.

Electricity in Local Exhibitions

St. Helens

AN electrical exhibition was opened on Monday last at St. Helens (Lancs). All the exhibitors' stands fit into a uniform scheme of design and colour treatment, with red and blue lettering on a buff or stone coloured ground. The cost of stand erection was borne by the Corporation. Domestic exhibits are grouped in the main hall of the Town Hall and the industrial plant in the Co-operative Assembly Hall—200 or 300 yards away. During the opening ceremony two "I'm Electric" nymphs, clothed in black, mounted guard on the dais, which was sectionalised, one portion being an electrical kitchen, another being reserved for cooking apparatus, a third for refrigerators, a fourth for water heaters and another for bathroom equipment.

During the run of the exhibition, which will remain open until to-morrow (Saturday), cooking demonstrations have been given each afternoon and evening. Continuous talking film programmes have been given, the films being "The Wizard in the Wall," "The Face of Britain" and a cartoon film. Housewives have the opportunity of winning Creda electric fires and a de luxe iron in an electric cake baking competition. There is also a poster judging competition. Thirteen E.D.A. posters, each identified by a key letter, are displayed. Visitors to the exhibition have to place them in what they consider to be the correct order of merit.

Woolwich

On Friday last an exhibition of Woolwich trade and industry was opened by Sir Malcolm MacAlpine at the Drill Hall, Woolwich. The exhibition was to have been held earlier in the month, but was postponed owing to the crisis. To mark the opening, Johnson & Phillips, Ltd., one of the exhibitors, held an informal lunch at the Shakespeare Hotel, Woolwich, at which Mr. C. Stewart, a director, presided. In proposing the toast of the guests Mr. Stewart explained that the exhibition had been organised by the Woolwich Chamber of Commerce and that the profits obtained from the letting of floor space and the sale of tickets were to be given to the Woolwich War Memorial Hospital. A number of electrical concerns in the district were taking part as well as the Woolwich Corporation Electricity Department, he said. Johnson & Phillips, Ltd., which was founded in 1875 at Charlton, although just outside the district, was naturally interested in the prosperity of the borough, in which many of its employés lived. It was also interested in the Polytechnic, where many of its young men received their technical training. He referred to the development of the Woolwich electricity undertaking under the direction of Mr. Elliott, the borough electrical engineer, especially on the domestic side. The number of consumers had increased from 4,000 in 1925 to over 30,000 to-day, while the sales during the same period had risen from 26 million kWh to 118 million kWh. Mr. Elliott, in responding for the guests, mentioned that the Woolwich Corporation endeavoured to place its orders for equipment with local concerns where possible. The Mayor of Woolwich and Ald. Potts (Carlisle) also spoke.

Part of the J. & P. stand at Woolwich

With so many well-known electrical concerns within and around the borough, the exhibition, although representative of the general industry of the district, has a distinctly electrical flavour. The Johnson & Phillips stand, of ample dimensions, has a display of high-voltage and low-voltage cables, including samples of cable used for the electrification of the Southern Railway (suburban). Oil circuit-breakers and transformers are also shown among the heavier equipment. A special feature is made of the "Charlton" domestic water heaters, to which attention is drawn by a clever adaptation of "Snow White and the Seven Dwarfs." Other equipment shown includes outdoor switchgear, cable accessories and instruments. The stand of the Woolwich Electricity Department has a comprehensive display of domestic electrical apparatus, and visitors are attracted to the various appliances by dramatised nursery rhymes. On the stand of W. T. Henley's Telegraph Works Co., Ltd., are two machines in operation—a braiding machine and an exhibit demonstrating how the Henley spark-testing machine tests rubber-insulated wires in the factory. The display of Standard Telephones and Cables, Ltd., includes remote control of street lighting, telephone cables, condensers, selenium rectifiers for all purposes, and radio valves. The stand of Siemens Bros. & Co., Ltd., has a selection of "Neophone" telephones, a private automatic telephone exchange, an air-raid signalling system, cables for various purposes (including television), dry cells and batteries, service fuse boxes and meters. Kolster-Brandes, Ltd., are showing a range of K.B. all-wave receivers, battery-operated and for mains. The exhibition closes to-morrow (Saturday).

Tipton

An industrial electrical exhibition was opened in the Sports Pavilion of the Midland Electric Corporation for Power Distribution, Ltd., on October 18th by Mr. C. Heathcock, the company's general manager. Mr. Heathcock explained that all the exhibitors were members of the M.E.C. Circle, which consists of manufacturers, authorised electrical contractors, and the supply company itself. There were fourteen exhibitors, and the motive behind the exhibition was to assist industrial users to meet the requirement of the new Factory Act. Consequently the exhibition consisted primarily of electric lighting, heating and ventilating equipment designed to further the welfare and safety of employés and provide efficient working conditions. At the same time, displays would be found of modern electric tools, welders, telephones, moulding machines and installation materials, including switchgear. Mr. Heathcock paid a tribute to Mr. H. Lamerton, the M.E.C. development engineer, who had had sole charge of the arrangements. The exhibition closes to-morrow (Saturday).

Manchester

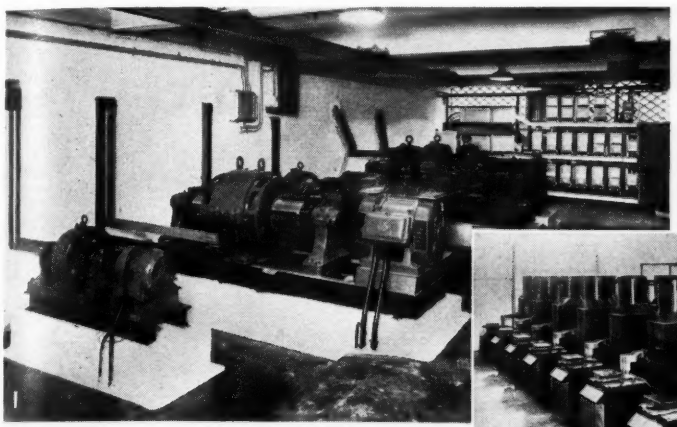
Electrically operated textile machinery was given much prominence at the Textile Exhibition held at Belle Vue, Manchester, last week. There were 128 exhibitors, and the plant was shown under working conditions. There was also a scientific display which, by the use of models and small coloured electric light bulbs, demonstrated variations in the molecular structures of certain textile fibres which account for differences in behaviour of the fibres when used. Thomas Broadbent & Sons, Ltd., showed a suspended electrically driven hydro extractor with fully automatic control, including reverse current brake, time control, safety cover, &c.

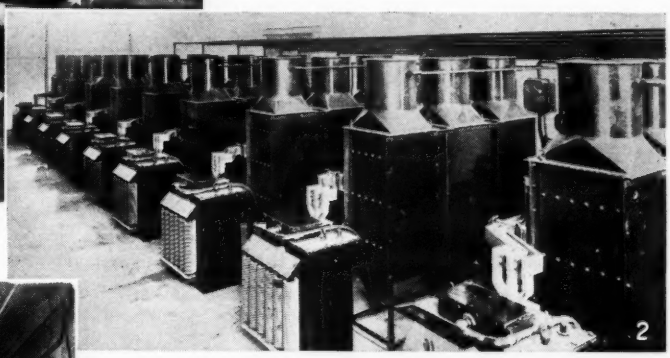
Applying Heavy Metal Deposits

A new Islington works

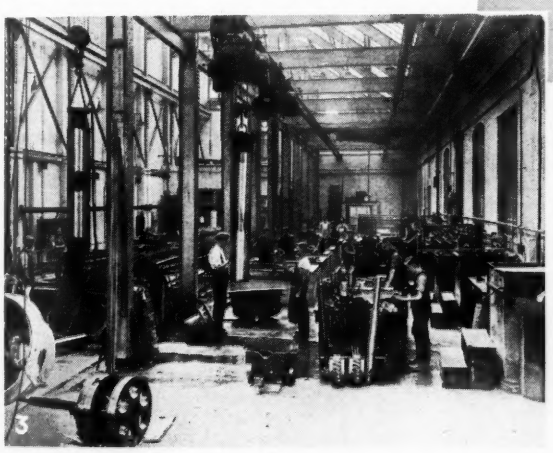
CONSIDERABLY improved facilities for carrying on its process of applying heavy deposits of metals on metals have been secured by Fescol, Ltd., at its new works at North Road, Islington. A floor space of 40,000 sq. ft. is now available and the plant is said to be the largest of its kind in the world. The process is used for the salvage of parts that have become worn in use, the rectification of machine-shop errors, securing protection against corrosion and improving the quality of wearing surfaces. Provision is made for the machining of parts to size after treatment.

Shafts up to 20 ft. long can be dealt with in the nickel-depositing shop, which is divided into three sections for heavy, medium and light work. A 6-ton runway used for loading and unloading heavy goods as well as for handling them in the vats, travels the whole length of the main bay. Other runways serve the medium and light sections (which also contain copper, cadmium and lead vats), thus minimising manhandling. The vats, 15 ft. deep by 12 ft. by 8 ft., are of ferro-concrete and are lined throughout with acid-resisting material.





1. Chromium generator room. 2. Some of the Westinghouse rectifiers. 3. Nickel deposition shop



Adjacent to the nickel shop and the inspection department (which contains appropriate instruments for fine measurements) is the chromium shop, where shafts up to 10 ft. 6 in. in length can be treated with the aid of 3-ton cranes. As in the case of the nickel shop, all vats are at a common height above floor level for convenience in handling, and there are no stagings or overhead constructions.

Independently driven polishing machines are installed in another shop, each spindle having its own exhaust to atmosphere. Notable among the machines in the extensive machine shop is a grinder capable of dealing with shafts up to 26 ft. long and 2 ft. 6 in. in diameter, and machines for grinding rolls 11 ft. long by 3 ft. 1 in. in diameter. Reference should also be made to the well-equipped analytical and research laboratory which covers an area of 2,000 sq. ft.

Electricity for the installation totalling 1,350 HP is obtained from the single-phase system of Islington Corporation and is converted to three-phase on the multi-capacitor pilot-motor system devised by the British Thomson-Houston Co. The convertors are three standard three-phase induction motors (supplying three distributing sections), and single-phase supply is connected to two terminals in each case. A condenser is connected between one of these terminals and the third, and the three-phase supply is taken from all three terminals. As the load increases, power fed through the condenser *via* the third winding of the pilot motor, which is substantially constant because the condenser reactance is fixed, tends to pass to the working motors rather than to the pilot motor. When the load exceeds the point at which the condenser does not supply enough third-line power, the difference is supplied by the pilot motor, which draws a corresponding amount from the single phase lines. The condenser thus acts as a rigid phase convertor passing a nearly fixed amount of power which is roughly the average needed by the load, whereas the pilot motor acts as a flexible convertor passing an amount of power, which varies with the load and may be positive or negative.

In order to secure automatic constancy of the third-line voltage condensers are also connected in a corresponding manner to all the large motors; the individual capacities of these had been determined from current readings, taken on the original site, to suit the normal load conditions in each case. Readings of voltmeters connected across the three-phase lines showed that the voltages were strictly comparable with those maintained in a normal system. It was said that practically the full rating of the working motors is obtainable with the usual temperature rise and that the full-load loss of each 50-h.p. pilot is 5 kW. The adoption of this method has enabled electrical plant from the former works, where the supply was three-phase, to be incorporated in the new scheme at a lower cost than by the installation of motor alternators, and has also improved the power factor.

For the deposition departments DC at low voltage is obtained from motor-generators and Westinghouse rectifiers installed in two rooms, one for nickel and the other for the chromium shop. Among the machines feeding the nickel shop is a motor generator with an output of 12,000 A at 6 V. Each motor generator associated with the chromium shop is connected directly to a vat.

Some of the power supply for the chromium shop is obtained through the metal rectifiers of which fifteen are installed having an aggregate maximum output of 16,500 A at 12 V. Each unit consists of a three-phase transformer and rectifier elements with fans mounted in cubicles, together with auto-transformers and control gear by the side of the vat. The rectifiers are brought into operation by a push-button which energises the main contactor coil with which is incorporated overhead protection. They are remote-controlled from the vats, control being effected on the input side of the auto-transformer. Two six-position on-load oil-immersed switches for each rectifier enable the voltage to be regulated in thirty-five equal steps between 4 and 12 V.

A nine-cell series-parallel battery by the Chloride Electrical Storage Co., having a capacity of 21,600 A at the ten-hour discharge rate is installed as stand-by. Mercury discharge lamps are largely used in the illumination of the different shops.

I.E.E. North Midland Students

The Committee of the North Midland Students' Section of the I.E.E. has decided to discontinue its annual dance and to hold a dinner instead. This will be held at the Hotel Metropole, Leeds, on November 25th, and tickets (4s. 6d. each) can be obtained from Mr. G. H. Waine, hon. secretary, 6, Parkfield Road, Shipley. Mr. A. Duxbury will deliver the students' lecture on November 1st at the Hotel Metropole, Leeds, his subject being "Public Speaking."

Commercial and Industrial News

Factory Lighting Campaign. I.M.E.A. Convention. E.I.B.A. Appeal. New Showrooms. Overtime Regulations. Hackney Propaganda. Ulster Lighting Campaign. Scottish Building Centre.

Factory Lighting Campaign

THE recent international troubles naturally slowed up E.D.A.'s Factory and Workshop Lighting Campaign, but it is again in full stride. The campaign was brought to the attention of 100,000 factory owners by means of a letter asking them: "Is your workshop lighting legal?" and enclosing a folder setting forth the advantages of good factory lighting. Two subsequent letters were sent at intervals, one of which drew attention to the importance of light measurement. On October 11th a comprehensive and reasoned book on "Lighting for Production" was circulated; this convincingly argues the case for good lighting as a valuable aid in production. The last "shot" was to be fired this week in the form of a complete "Guide to Illumination Values." In reporting these activities the Association stresses the urgent need for local support by supply authorities in driving the message home, including the provision of lightmeters for their staffs, making immediate contact with factory owners who ask for lighting surveys and initiating such surveys in the premises of those who have not responded.

The 1939 I.M.E.A. Convention

The Secretary of the Incorporated Municipal Electrical Association (Mr. J. W. Simpson) informs us that owing to certain difficulties the Council has regretfully rescinded its decision to hold the 1939 Convention at Llandudno and has accepted the invitation of the Mayor and Corporation of Harrogate. The date of the Convention is still from June 5th to 10th.

Mr. E. E. Sharp's Appeal

In the course of a letter to the Press Mr. Ernest E. Sharp, the President of the Electrical Industries Benevolent Association, puts forward an appeal to men and women in the industry to support the E.I.B.A. funds according to their means. As a rough guide he suggests that they should subscribe ¼d. per £ of their income for the first £480; 1d. for the next £480; 1½d. for the third, and so on. (Thus a man earning £500 would give £1 1s. 8d. and a £1,000-a-year man £3 5s.). He also suggests that subscribers should persuade their colleagues to give to the funds.

Mr. Sharp stresses the fact that membership is for non-technical as well as technical non-manual workers and that relief extends to widows and dependants. If a man's future is not certain self-interest will dictate membership of the E.I.B.A.; if the financial future is secure beyond a doubt sheer thanksgiving should prompt subscription. The address of the E.I.B.A. is 6, Southampton Street, London, W.C.1.

New Showrooms at Rye

The ancient borough of Rye comes within the area of electricity supply of Hastings Corporation, and in order to promote and develop the use of electricity for domestic purposes new showrooms have recently been opened there. Situated in Cinque Ports Street, the main thoroughfare, the premises are in a commanding position opposite the entrance to the station and also the market. They are constructed on generous lines with four large display windows in the front of the building. The main showroom has a well-arranged display of domestic appliances which includes electric cookers, fires, lighting fittings and small apparatus, while there is also a demonstration electric kitchen. In sending us the accompanying illustrations, Mr. A. J. Ryan, borough electrical engineer, Hastings, states that the premises have attracted considerable attention and a good deal of business has already been achieved.

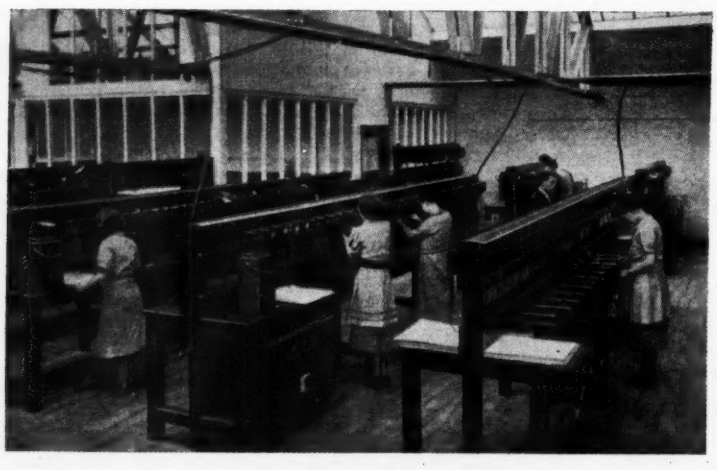
An exterior view of the new Rye showrooms of the Hastings Corporation Electricity Dept. and one of the new apartments

Price Reductions

The General Electric Co., Ltd., announces reductions in the prices of "Gecoray" silvered glass shop window lighting reflectors as from October 1st. There are twenty-seven standard models available to suit different types and sizes of windows, and prices of many models have been reduced by at least 20 per cent.

New Offices and Showrooms at Tame Valley

On Tuesday last the new offices and showrooms of the Stalybridge, Hyde, Mossley and Dukinfield Transport and Electricity Board were formally inaugurated at Tame Valley, Stalybridge. The first generating station of the Board was situated at Tame Valley and this plant was closed as a generating station in 1932. It is here that modifications to buildings have taken place to provide up-to-date offices and workshops. Since the Board adopted the policy of domestic electrification in 1929 the number of consumers has increased by 22,000, with a consequent increase in staff to deal with the new business obtained.



A section of the meter-testing station of the S.H.M.D. Board at Tame Valley

The workshops and stores occupy the whole of the old boiler-house site. The offices on the front of the old generating station have been modified and the pump room and tank room have been converted into airy and well-lighted offices. Having over 45,000 meters in service on consumers' premises (including many complicated industrial equipments) it was decided to equip the test room with a comprehensive set of instruments and loading apparatus, and so carry out all the testing and standardising necessary to ensure full compliance with the 1936 Electricity Supply (Meters) Act, and with the modern equipment which has been installed it is possible to test every type of

metering equipment and to reproduce in the test room any condition that may arise in service. Above the general stores is a department for repairing and testing domestic appliances. An engineering shop deals with all general construction and repair work that is likely to be encountered on the distribution side of the undertaking, while a joiners' shop adjacent to the fitting shop carries out general joinery work for each section of the Electricity Department. The Board's mains cover an extensive area and all problems relating to this section of the undertaking are dealt with at Tame Valley, where there are offices and workshops. Special attention has been paid to the rapid restoration of supply in cases of breakdown. The new showrooms will be used to house the staff connected with the establishment, who are responsible for dealing with all orders received at the branch showrooms. There is a large room for the demonstration of domestic electrical appliances, which the Board offers on simple hire and hire-purchase terms, a modern bathroom and a demonstration kitchen. The canteen includes an electric kitchen. The new premises also include a drawing office, general stores, records, costs and filing departments. The whole of the work of adaptation and reconstruction has been carried out under the supervision of Mr. J. Harwood Lumsden, chief engineer to the Board.

Overtime Regulations

The Home Secretary has made, under the Factories Act, 1937, the "Factory (Individual Overtime) Regulations, 1938," in respect of "factories in which is carried on the manufacture of a variety of light metal articles or of fittings or accessories composed wholly or largely of metal." These regulations provide that the occupiers of such factories may elect to vary the provisions of Section 73 of the Act which governs the overtime employment of women and young persons over sixteen as set out in Sub-section 9 (*a*) and (*b*) of that Section. Copies of the order (No. 1228) can be obtained from the Stationery Office (1d. net).

A. C. Cossor, Ltd.

The directors ask us to state that this company is conducted quite independently of and is not controlled by any other company or group of companies. The members of the board are Sir George Cochrane Godfrey (chairman), Messrs. T. S. Cornwell, A. H. Johnson, A. E. Somers, E. J. Strutt and J. H. Thomas (managing director). Mr. J. Ismay has recently resigned his directorship and Mr. Thomas is now the sole managing director.

Artistic Lighting Fittings

A remarkable variety of lighting fittings is to be seen at the extended "Lighting Centre" of Troughton & Young, Ltd., Knightsbridge, S.W.1. All of them possess distinct artistic merit, whether in their simplicity of line or decorative effect, and they are displayed most advantageously. One innovation

One of the revolving displays at Troughton and Young's "Lighting Centre"

is a circular central control table with sixty switches in two rows on its periphery. These are numbered, which makes it an easy matter to switch on any particular fitting for inspection. In addition, some of the switches control revolving displays arranged in the walls, which contain fittings in appropriate settings. An ingenious arrangement of architectural features enables fittings to be shown in their proper environment. In the basement is a comprehensive display of commercial and industrial lighting fittings and another apartment is set aside for television demonstrations. The extensions include a new drawing office and stores and increased office accommodation.

Widow's Compensation Claim

In our last issue we reported an action by Mrs. R. M. Harris against Dorman, Long & Co., Ltd., and others, claiming damages in respect of the death of her husband, an electric welder employed at Fulham power station. The Judge found that the action should have been brought against the Fulham Borough Council which, however, was able, if it desired, to plead the Public Authorities Protection Act as the case had not been brought within six months of the accident.

The case again came before Lord Justice Goddard on October 21st, when Mr. Rewcastle, K.C., said that Mrs. Harris had in the circumstances decided to persevere with her claim for compensation under the provisions of the Workmen's Compensation Acts against his employers. The question for decision and argued was whether or no the widow was debarred from an award in her favour under the provisions of those Acts by reason of the delay. During his argument Mr. Rewcastle stated that since the case was last before the Court the Fulham Borough Council had made an *ex-gratia* payment of £50 to Mrs. Harris.

Giving judgment on Wednesday last Lord Justice Goddard held that no reasonable cause had been shown why the claim for compensation had not been brought within the statutory period and it must be dismissed.

Leicester Lighting Conference

An E.D.A.-E.L.M.A. Public Lighting Conference is being held to-day (Friday) at the Bell Hotel, Leicester. The speakers will include Mr. T. Catten, who will speak on "The New Era in Electric Lighting," and Mr. S. S. Begg, who will deal with modern street lighting. In the evening several representative street-lighting installations will be inspected. Further conferences will be held at Wolverhampton on November 10th and at Halifax early in December.

Modern Lighting Practice

Nearly 300 persons attended the first of a series of six lectures under the auspices of the E.L.M.A. Lighting Service Bureau at Manchester on October 19th. The speaker was Mr. W. J. Jones, M.Sc., M.I.E.E., who gave a review of modern lighting practice. He said the capital invested in electricity supply undertakings was over £500,000,000 and the lighting load represented about half the output of the power stations. He gave an interesting demonstration to show various lighting intensities. There was a series of strips to represent light conditions under trees, under verandahs, in a bright room and in a dull room. He said it was now indisputable that good lighting was an essential factor of health. In factories and workshops greater productivity had been assured by installing lighting fittings of ample capacity. The main points of Mr. Jones's address were illustrated by lantern slides. Mr. J. H. Farthing, a director of the G.E.C., presided.

Price of Materials

Henry Gardner & Co., Ltd., report, October 26th:—Copper bars (best selected), sheet and rod, £82. £2 increase. English pig lead, £18 5s., 5s. decrease. Spelter, no change. English block tin, £211, £4 increase. Mercury, no change.

Frederick Smith & Co. report, October 26th:—Electrolytic copper bars, £52 10s., £1 10s. decrease. Ditto, ditto, wire rods, £57 5s., £1 10s. decrease. Ditto, ditto, h.c. wire, 8$\frac{7}{8}$d., $\frac{3}{8}$d. decrease. Silicium bronze wire, no change.

Edward Till & Co. report, October 26th: India-rubber, Para fine, no change.

Type "B" Lamps

The Metropolitan-Vickers Electrical Co., Ltd., announces the introduction of a 25-W type "B" lamp at the same price as the usual type "B" lamps.

The Importance of Purchasing

Speaking at the annual dinner of the London Branch of the Purchasing Officers' Association recently Mr. D. W. Turner, director of Wrights Ropes, Ltd., the principal guest, said that for many years there had been an assumption that no especial knowledge or technique was needed for purchasing; actually there was no limit to the knowledge required by the purchasing officer in order to perform his job in the scientific way demanded by modern industry. The president of the Association, Mr. C. W. Kelsey (purchasing controller of the London Electric Wire Co. & Smiths, Ltd.), agreed with Mr. Turner that there had been a definite advance in the prestige enjoyed by the purchasing officer during the past seven years. He felt that this was mainly due to quiet propaganda and education within the Association itself. Other speakers were Mr. H. M. Close, stores buyer of the Gas Light and Coke Co. and chairman of the London Branch of the Association, and Mr. G. Y. Finlay-Campbell, deputy-director of Nobel Chemical Finishes, Ltd.

Planning Lighting Installations

The Mortimer Gall Electrical Centre, 115/117, Cannon Street, E.C.4, is issuing a series of cards dealing with the correct planning of lighting installations.

I.E.E. Transmission Section Dance

The annual conversazione and supper-dance of the Transmission Section of the I.E.E. will take place as before at the Criterion Restaurant, Piccadilly, on November 2nd. Tickets, 10s. 6d. per person, are obtainable from the secretary of the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2.

Hackney Electric Home Campaign

To enable every resident in Hackney to become familiar with the many electrical appliances which are available for providing greater ease, comfort and convenience in the home the Electricity Department has staged a special series of demonstrations and displays which will continue throughout October and run into the first weeks of November. The theme upon which the displays are based is "The Electric Home is Hackney's Aim," and throughout the showrooms the different

rooms of the home are depicted with pictorial backgrounds and with the various pieces of electrical apparatus arranged in appropriate positions. There is also a special display for garage and garden electrical appliances. The special water heating room shows an over-sink kitchen water heater, a bath water heater and a household water heater, on hire respectively at 2d., 6d. and 9d. per week. A wash boiler and two types of washing machine are also on show in this room. The fires room is attractively arranged, with a mantel surround containing a Berry's "Chameleon" fire which provides a focal point of interest. A full range of the latest pattern electric fires and heaters is displayed upon tier stands at each side. The two main front windows have been dressed respectively for apparatus which may be hired, and for appliances on sale. The publicity arrangements include sixteen-sheet and double-crown posters displayed throughout the district; half-page advertisements in the local Press; lantern slides; canvas streamers, and the distribution from door to door of a specially printed folder containing a prize coupon. Presentation of this coupon at the showrooms entitles the bearer to participate in a prize draw, in which pieces of electrical apparatus are awarded daily. Demonstrations are conducted at the showrooms from 9 a.m. to 7 p.m., with special demonstrations of electric cookery every afternoon at 3 o'clock.

A Display Stand for Irons

We have received from Morphy-Richards, Ltd., one of their new display stands for their auto-control electric iron. This has a stand for the iron attached to a showcard illustrating an attractive young lady who points to the electric iron. The showcard has a silver backpiece over which the flex from the electric iron can be hung. Suitable wording on the card draws attention to the special features of the iron.

Hotel Lounge Lighting

The furnishing, lighting, and equipment of hotel lounges is a matter of very careful planning nowadays, and nothing is left to chance in the provision of up-to-date amenities. At the Royal Hotel, Clacton-on-Sea, a number of alterations has been made, especially in the lounge, in which bright and cheerful lighting has been installed. The installation was carried out to the designs of Mr. S. Osborne, architect for Daniell & Sons' Breweries, Ltd., and G.E.C. illuminating engineers were invited to collaborate in planning the lighting. The scheme embraces three special cupola features 11 ft., 12 ft. and 13 ft. 6 in. in diameter, each housing a plaster cove accommodating a silvered glass reflector equipped with "Osram" lamps arranged at 6 in. spacing. The largest feature is fitted

The lighting of the lounge of the Royal Hotel, Clacton

with eighty lamps, the intermediate and smaller ones having sixty-eight and sixty-four lamps respectively. The troughing is arranged in sections, with wiring channels at the back for accommodating the lamps in groups of four. This lighting is supplemented by a number of specially designed brackets of chromium metalwork for semi-indirect lighting. These are arranged as wall and panel features; the lighting emanates from the top of the units and is distributed through sand-blasted plate-glass discs with clear polished edges. The installation was carried out by Mr. H. E. Gosnell, of Colchester. The fittings referred to were manufactured and supplied by the General Electric Co., Ltd., as were also the conduit and accessories and various lighting accessories.

Municipal Supply Undertakings' Results

We regret that in the table of municipal supply undertakings' results published last week the total sales of the East Ham Electricity Department were incorrectly given. Actually 29,848,000 kWh was sold in the past year compared with 27,727,000 kWh in 1936-37. The proportionate increase in sales at Erith should have read 19.7 per cent.

Lighting Campaign in Northern Ireland

The Minister of Commerce for Northern Ireland (the Rt. Hon. J. Milne Barbour, M.P.) was the principal guest at a luncheon held recently at Belfast to inaugurate the "Better Light—Better Sight" campaign in Northern Ireland for 1938-39. He said that as the Minister responsible for the supervision of electrical services in Northern Ireland he was naturally interested in any development in this direction. He had recently heard of some remarkable improvements in factory output resulting from proper attention to lighting facilities. For example, he was told that in a recent experiment by doubling the illumination in a silk weaving shed production was increased by as much as 21 per cent. The chair was taken by Mr. R. A. Boyton, M.I.E.E., and an address on lighting was given by Mr. M. W. Hime, A.M.I.E.E., manager of the E.L.M.A. Lighting Service Bureau of Scotland. A vote of thanks to the speakers was moved by Mr. F. H. Whysall, M.I.E.E., manager and engineer of the Belfast Corporation Electricity Department, seconded by Mr. A. Scott (Edison Swan Electric Co.). The luncheon was held under the joint auspices of E.L.M.A. and the Northern Ireland Committee of the Electrical Development Association, whose secretary, Mr. H. Boyd, was responsible for its organisation.

English Electric Engineering Society

The opening address of the 1938-1939 session of the English Electric (Stafford Works) Engineering Society was given by Professor M. L. Oliphant, F.R.S., Ph.D., of Birmingham University, who took for his subject "The New Fundamental Particles of Matter." The chair was occupied by Mr. J. Rogers (general manager of works) and the Society, which has a membership of over 900, was represented in large numbers. Professor Oliphant, in the course of his lecture, proceeded to explain in detail the attitude of physical science at the present time towards matter as contrasted with the older theories. In the olden days it was thought that matter was built up from atoms which chemists regarded as small particles, characteristic of a substance and combining together to form the objects of the material world. The question of the composition of the atom had now been raised. So far science had found out that the atom consisted of several different kinds of particles such as protons, electrons, neutrons and the new heavier particle, the so-called "heavy electron," which had been recently discovered. The lecture was illustrated by lantern slides and a demonstration was given showing the counting of particles emitted from a radio-active source. A vote of thanks was proposed by Mr. F. Wallis.

Brighton Transport Change-over

In connection with the forthcoming change at Brighton from tramway to trolley-bus operation Crompton-West announce that they have received an order for forty-four sets of electric traction equipment for the new vehicles. The complete trolley-buses will be supplied by the Associated Equipment Co., Ltd., and will be of the two-axle, covered double-deck type seating fifty-four passengers. The electrical equipment is of the regenerative-rheostatic type, incorporating run-back and coasting brake with battery manœuvring and battery charging from an overhung direct-driven generator. Both motors and control gear (all electric contactors) are of standard Crompton-West design, the motors being manufactured by Crompton Parkinson, Ltd., and the control gear by Allen West & Co., Ltd. The equipment throughout is to the specification and approval of the Brighton transport manager, Mr. W. Robinson.

Met.-Vick's Unusual Sideline

Electrical visitors to the Brewers' Exhibition which opens at the Agricultural Hall to-morrow (Saturday) may be surprised to learn when inspecting the stand of Samuel Fox, Ltd., that the handsome stainless steel beer barrel was produced by the Metropolitan-Vickers Electrical Co., Ltd. It is an example of the company's work in developing engineering materials for particular purposes and the art of welding. The company tells us that it has already made and supplied many thousands of such barrels in specially treated aluminium and in stainless steel. The welding is carried out by a patented process ensuring a perfectly smooth interior. This type of barrel was introduced primarily for the lager trade, but it is being adopted for heavier types of beer. So far as we are aware, it is not the company's intention to go still further and supply the contents too.

Scottish Contractors' Year Book

The "Year Book and Diary, 1938-39," of the Electrical Contractors' Association of Scotland (3s. net, 3s. 6d. post free) is in similar form to previous editions. The literary matter, which is again preceded by the portraits of the president, vice-president, branch chairman, consultant and solicitor, and the general secretary, contains a fund of information invaluable to electrical contractors, and in addition to association matters includes conditions of contract, lists of members of trade associations, maps of the areas of electricity supply of the principal Scottish authorities, and a "Where to Buy" guide. This year the diary has been extended to December 31st, 1939, instead of ending on September 30th as formerly, and the Committee has decided that further issues will be made at the beginning of each year.

The Scottish Building Centre

A five-storey building, at 425-427, Sauchiehall Street, Glasgow, was opened on October 21st by Mr. J. Scrymgeour Wedderburn, M.P., Under-Secretary of State for Scotland, as a permanent exhibition place for building materials, furnish-

ings, &c. It is to be known as the Scottish Building Centre, and has been promoted by the Scottish Development Council. At the opening ceremony Mr. Wedderburn expressed thanks to the London Building Centre for co-operating in the Glasgow project. The Centre has two large display windows facing Sauchiehall Street and near the busy junction of Charing Cross. In the building there are sections devoted to ironmongery, electricity, timber, paint, windows and glazing, and plumbing. The electrical section is prominently placed on the first floor. The first thing which greets the visitor on leaving the lift is the illuminated display in the Centre on which is to be seen a wide variety of lamps. Round the walls of the section are lighting cubicles, each being the exhibit of a leading British manufacturer. Here one sees an attractive display of lighting fittings for ceiling, wall, and desk. Other wall cubicles are occupied by clocks and an emergency lighting set, while under the lighting cubicles themselves are arranged electric fires of various manufacture. A central island in the section includes refrigerators, washers, cookers, &c., and there are also displayed self-contained generating plants. Immediately outside the main electrical section is a smaller section devoted to electrical accessories. The Area Officer for Scotland of the British Electrical Development Association has his office in the electrical section and will give information on matters relating to electricity.

E.A.W. Activities

About two hundred persons attended the inaugural meeting of the Oxford Branch of the Electrical Association for Women at the Town Hall on October 17th. Opening the proceedings, the chairman, Mrs. D. B. Mair, emphasised the necessity for co-operation with electricity supply authorities and manufacturers. Mr. F. G. Fraser, manager of the City of Oxford Electricity Supply Department, welcomed the venture and pointed out that the cheap rates available in the city made it particularly suitable for the formation of a branch. Two consumers in every seven were now using electricity for cooking and water heating. Mr. R. B. Brown, of the Wessex Electricity Co., also promised support. Mrs. Wickham Steed is president of the new branch.

Professor Winifred Cullis discussed the principal factors in maintaining good health at the seventh business hour lunch of the London Branch last week.

Midland Electrical Engineers' Ball

The annual Midland Electrical Engineers' Ball will be held at the Grand Hotel, Birmingham (Grosvenor Suite) on December 9th under the presidency of Mr. S. T. Allen, manager for the Central Electricity Board, Wake Green Road, Moseley, Birmingham, 13. The chairman is Mr. W. H. Heaton, works manager of the General Electric Co., Ltd., Witton, and the hon. secretary is Mr. W. Y. Anderson, 12, Richmond Park, Olton, Birmingham, 27. Early application for tickets should be made to the above or any committee member.

New Catalogues and Lists

F. W. Sturgess, Park Lane, Ashtead.—A catalogue of thermal and thermo-magnetic flashers for all purposes.

R. & A. G. Crossland, Price Street, Birmingham, 4.—A 48-page catalogue of industrial and commercial reflectors and lighting fittings.

C.A.V.-Bosch, Ltd., Acton, London, W.3.—A list of panels, fuse-boxes and control boards for marine craft.

British Electrical & Manufacturing Co., Ltd., 13, Charlotte Street, Oxford Street, London, W.1.—An illustrated catalogue of electric fires.

British Rola Co., Ltd., Minerva Road, Park Royal, London, N.W.10.—A folder dealing with the "Rolamatic" iron.

Switchgear & Equipment, Ltd., Delavox Works, Banbury.—An illustrated folder dealing with high-voltage oil-immersed switchgear.

Midland Electric Manufacturing Co., Ltd., Tyseley, Birmingham, 11.—A comprehensive illustrated catalogue of motor control gear.

Higgs Motors, Ltd., Witton, Birmingham, 6.—A broadsheet in the form of a large letter advertising low-starting-current squirrel-cage motors.

Siemens Electric Lamps & Supplies, Ltd., 38-39, Upper Thames Street, London, E.C.4.—List No. 665 dealing with "Full-o-Power" batteries for torches and cycle lamps.

T.M.C. Harwell (Sales), Ltd., 233, Shaftesbury Avenue, London, W.C.2.—Two new pages for insertion in the company's loose-leaf clock catalogue.

Evershed & Vignoles, Ltd., Chiswick, London, W.4.—A folder advertising security by the use of the "Megger" insulation tester.

Watson & Sons (Electro-Medical), Ltd., 43-47, Parker Street, Kingsway, London, W.C.2.—An illustrated brochure dealing with the "Kingsway" dental X-ray unit.

Private Arrangement

H. Bywater, H. J. Bywater, A. E. Bywater and **K. L. Alderton,** radio and electrical engineers, trading as Woodford and District Electrical Co., 25, High Road, Woodford Green.—At a meeting of the creditors a statement of affairs was submitted showing ranking liabilities of £402. The net assets were £140, leaving a deficiency of £262. It was decided that the estate should be dealt with under a letter of authority to Mr. C. Latham, accountant, 185-188, High Holborn, London, W.C.

Receiver Released

Goldhawk Electric Co., Ltd.—C. G. Peel, of 113, Kingsway, W.C.2, ceased to act as receiver and manager on October 13th, 1938.

Bankruptcy Proceedings

V. W. Henry, Acle, Norfolk, radio and electrical engineer.—At the public examination held on October 18th at the Shirehall, Norwich, debtor said his failure was due to excessive overhead expenses and depreciation of plant. His statement of affairs showed gross liabilities of £870, of which £760 was expected to rank for dividend, and there was a deficiency of £558. The examination was closed.

H. White, Ridgeway Lane, near Ambergate, and lately carrying on business at 38, Nottingham Road, Ripley, both Derbyshire, radio and electrical engineer. At the public examination held at the Court House, 20, St. Peter's Churchyard, Derby, on October 18th it was stated that there were unsecured liabilities of £1,148 and a deficiency of £282. The Official Receiver pointed out that the amount of deficiency now shown in debtor's statement of affairs depended upon whether he received £500 in respect of his claim against a business in which he was formerly interested. The examination was adjourned.

E. F. Hunt, "St. Albans," Cherry Chase, Tiptree, Essex, radio and electrical dealer, lately trading with another as Hunt's Radio Service, Cameron House, High Street, Ingatestone, Essex, as radio and electrical dealers.—The application for discharge was heard at the Shire Hall, Chelmsford, recently. The receiving order was made last year. It was stated that debtor was at present employed, and did not intend to recommence business on his own account. The discharge was granted subject to two years' suspension.

M. R. Horne, trading as Malcolm & Stewart, 491, Alum Rock Road, Birmingham, wireless and electrical retailer.—The first meeting of creditors was held at the Official Receiver's Office, Somerset House, 37, Temple Street, Birmingham, on October 19th. The statement of affairs showed liabilities of £452 and assets of £289, leaving a deficiency of £163. The matter was left in the hands of the Official Receiver.

W. C. Hanson (Kenilworth Radio Supplies), radio engineer, 78, Priory Road, Kenilworth, lately residing and carrying on business at 37, Warwick Road, Kenilworth.—Bankrupt discharged as from October 23rd, 1938.

H. N. Wicks (Harold Wicks & Co.), electrical specialist, Railway Hotel Buildings, Greenhithe, and 3, Stone Street, Gravesend.—Last day for receiving proofs for dividend November 4th. Trustee, Mr. F. C. Wells, 280a, High Street, Rochester, Official Receiver.

E. G. Kelf and **L. F. Brewer** (E.G.K.), radio dealers, lately carrying on business at 4, High Road, Willesden Green, N.W.10.—Receiving order made October 14th on a creditor's petition. Public examination December 15th at Bankruptcy Buildings, Carey Street, W.C.2.

L. W. Squirrell, radio dealer, Langstoft, Baron Estate, Berechurch Road, Colchester, lately carrying on business at 372, Woodbridge Road, Ipswich.—First meeting October 28th at 13a, Great Colman Street, Ipswich. Public examination November 3rd at the Shire Hall, Ipswich.

S. R. Phipps, electrical engineer, Alcester Road, Studley, Warwickshire.—Public examination November 25th at the Shire Hall, Warwick.

N. G. Crews, electrical engineer, 99, Clapham Road, Lowestoft, and lately carrying on business at 34, Crown Street, Lowestoft.—Discharge suspended for three months until December 22nd, 1938.

A. C. Dobbing and **A. Ll. Rothery** (Ripon Electrical Co.), electrical engineers, 39, Kirkgate, Ripon.—Last day for receiving proofs for dividend November 2nd. Trustee, Mr. W. A. Kay, Lantern Tower Chambers, Coppergate, York, Official Receiver.

E. A. Cartwright, radio dealer, lately residing and carrying on business at 71, Melton Road, West Bridgford, and now residing at 8, Heskey Street, Nottingham.—Last day for receiving proofs for dividend November 2nd. Trustee, Mr. A. J. Rogers, 22, Regent Street, Park Row, Nottingham, Official Receiver.

Company Liquidations

Star Electric Works (Newcastle), Ltd., Newcastle-on-Tyne.—At the statutory meeting of the creditors held recently at the offices of S. M. Bell & Co., 87, Westgate Road, Newcastle-on-Tyne, it was reported that the company had gone into voluntary liquidation and Mr. S. M. Bell had been nominated as liquidator. The statement of affairs disclosed liabilities of £1,178, all due to unsecured creditors. The deficiency in the statement of affairs was attributed to the loss on the trading during the latter period, together with the depreciation written off the assets. During the discussion Mr. S. A. Wherly, the managing and sole director of the company, intimated that he would supplement any dividend produced by the assets of the company by a further 1s. in the £. A resolution was passed confirming the voluntary liquidation of the company with Mr. S. M. Bell as liquidator.

Stanedge Radio Ltd.—Meeting November 19th at 44, Belsize Square, Hampstead, N.W.3, to receive an account of the winding up by the liquidator, Mr. G. L. Lawrence.

Information Department

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

AUTOMAS blind control.
HOLDALITE telescopic floodlight.
ALPHA cable connector.
SILLET resistance tubes.
LOK-LITE lamp locks.
BRITEX domestic appliances.

Electricity Supply

Lighting, Domestic, Power

Abergynolwyn.—SUPPLY TO BE RESTORED.—Until eight months ago the village was supplied with electricity from the private generating plant owned by Sir Hadyn Jones, M.P., to whom the greater part of the village belongs. Owing to overloading of the plant, through the inhabitants using the supply for purposes other than lighting, however, Sir Hadyn discontinued the service. He was subsequently interviewed by a deputation, and has now consented to restore the supply subject to a specified type of lamp being used for household lighting. Housewives may use electric irons for two hours on Tuesdays and Thursdays, apart from which the supply will be restricted to lighting.

Accrington.—STREET LIGHTING CONVERSION.—Over 1,000 lamps in side streets have now been converted from gas to electric. The scheme will be completed in the New Year.

Baildon.—ELECTRICITY CHARGES.—The Council has asked the West Riding District Councils' Association to convene a meeting to discuss the charges of the Electrical Distribution of Yorkshire, Ltd. It considers that the company should be asked for an investigation by an independent accountant of certain financial aspects of the cost of supplying electricity. The Council's Law and Parliamentary Committee proposes that unless there is some reduction in the price of electricity street lighting by gas on the new estates should be considered.

At the E.D.A. film première last Monday (see page 615):—Left: Mr. and Mrs. A. E. McKenzie. Centre: Mr. and Mrs. A. C. Cramb, Brig.-Gen. R. F. Legge (chairman of the E.D.A. Council) and Mrs. Legge. Right: Mr. and Mrs. R. P. Sloan with Mr. J. I. Bernard (E.D.A.)

Banff.—QUARRY PLANT SCHEME DEFERRED.—The County Council has referred back for further consideration a sub-committee's proposal to establish an electric stone-breaking plant at Berrymuir quarry, Macduff, at an estimated cost of £11,500.

Bedford.—DISTRIBUTION SCHEMES.—The Electricity Committee is to extend the mains to Husborne Crawley (cost £827) and to Crawley Crossing (£583). A sub-station is to be provided at Bromham at a cost of £2,757.

Bentley (Yorks).—SCHOOL LIGHTING.—The West Riding Education Committee is being urged by the Bentley District Education Sub-Committee to install electricity in the Arksey (Yorks) school, the existing gas lighting being inadequate.

Hanger Lane, Ealing, illuminated by 125-W "Mercra" lamps in B.T.H. "County Junior" lanterns. The existing columns were utilised, and fitted with special extension brackets to provide a 16-ft. mounting height for the lanterns

Bexhill.—NEW MAINS.—The Electricity Committee is to extend the mains to houses in Dane Court Close at an estimated cost of £264.

Bournemouth.—SUB-STATIONS.—The Bournemouth & Poole Electricity Supply Co. is to erect sub-stations in Leybourne Avenue and St. Peters Road.

Brighton.—STAIRCASE SWITCHES.—The Housing Committee has decided in favour of the installation of dual lighting switches for the staircases of Council houses if tenants are willing to pay one half of the cost of the work (10s. 6d.). The Finance Committee, however, is not in favour of the Council bearing any part of the cost.

Chichester.—INCREASED CHARGES.—The Council has increased its electricity charges by 10 per cent., and cooker hire charges have been raised where consumption is less than 800 kWh per quarter.

Craster (Northumberland).—SUPPLY INAUGURATED.—Electricity is now available in the village from the North-Eastern Electric Supply Co.'s mains.

Darlington.—STANDBY SUPPLY SETTLEMENT.—Following discussions with the Central Electricity Board the Town Council has agreed to pay the Board £2,302 for a standby supply of electricity from the grid during 1937.

Eastry.—OVERHEAD LINES.—The Rural District Council has approved a proposed extra-high-voltage line from Fairfield Road, Minster, to Plumstone Road, Acol, and low-voltage lines from the latter point to Cleve Court, Crown and Sceptre, and Crisps Road, Acol.

Edinburgh.—SUB-STATION.—William Crawford & Sons, Ltd., have been granted permission to erect a sub-station and sprinkler pump room at Salamander Street, Leith.

Elstree.—EXTENDED LIGHTING.—An expenditure of about £1,000 is likely in connection with public lighting extensions which the Parish Council proposes to carry out.

Falkirk.—A.R.P. EQUIPMENT.—The electrical engineer has reported to the Electricity Committee that in connection with air raid precautions, and in view of the Electricity Commissioners' recommendations, it will be necessary to purchase the following: Two 500-kW transformers, two sub-station switchboard loop-in units, six spare switches for the generating station and main sub-stations and 1,000 yd. of high-voltage cable at a total cost of £2,700.

Greenock.—NEW CABLES.—Cables are to be laid to supply new houses at Port-Glasgow and Gourock. The cost of replacing a number of old cables in the vicinity of the Hunter Place sub-station is £1,400.

Guisborough.—RURAL SUPPLIES.—The scheme for supplying electricity to Lackenby, Wilton, Dunsdale, and Newton-under-Roseberry will be completed shortly. There will be an official switching-on ceremony.

Hull.—LOANS FOR PURCHASE OF APPARATUS.—At a recent meeting of the Electricity Committee the general manager (Mr. D. Bellamy) suggested that instead of financing hire-purchase schemes out of the reserve fund short-period loans should be raised for the purpose. The reserve fund, he said, was less than half of what it could be by statute. The Committee gave its consent.

Keighley.—BAKING TARIFF.—The Electricity Committee has decided that electricity shall be supplied for industrial baking of bread and confectionery at the following scale of charges: Day-time load, 0.5d. net per kWh and night load (midnight to 6 a.m.) at 0.35d., subject to the coal clause in the standard agreement. The 0.35d. rate is to apply only if the day-time load is not less than 100,000 kWh per annum.

Kimpton (Herts).—SUPPLY SCHEME.—It is reported that the "Northmet" Co. will probably complete by Christmas a scheme for supplying electricity to Peter's Green, in the Kimpton rural district.

Leeds.—EXTENSIONS AT KIRKSTALL.—A direction has been received from the Central Electricity Board for the Council to extend the Kirkstall power station at a cost of £720,000, increasing its capacity by 30,000 kW to 110,000 kW.

London.—SOUTHWARK.—The Electricity Committee is to carry out assisted wiring at an estimated cost of £938 and is seeking sanction to borrow £10,000 for further assisted wiring.

FULHAM.—The Central Electricity Board has issued a direction for the installation of two additional boilers each of 270,000 lb. per hr. maximum evaporative capacity at the power station, to be ready for commercial operation by September, 1940. It has agreed to the Council's request that the work should be carried out by the Council's staff, assisted by consulting civil engineers, but mentions that it does not follow that the Board will agree to this procedure in giving directions for a major extension. The estimated cost of the work is £600,000.

ST. MARYLEBONE.—The Electricity Committee is to install rising mains at Cornwall Mansions at a cost of £150.

ST. PANCRAS.—The chief electrical engineer and manager has reported that most of the high-voltage switchgear originally installed in the various rotary sub-stations is of inadequate rupturing capacity to deal safely with present-day emergency conditions. The complete modification of this switchgear will involve a considerable capital expenditure, and it is suggested that the alterations should be carried out gradually, commencing with the Regent's Park and Grafton Road sub-stations where the cost will be about £4,300.

In June the Council approved in principle a street lighting improvement scheme providing for the substitution of electric-discharge lamps for the existing method of illumination in various streets. It is now proposed to proceed with the re-lighting of a number of streets at a cost of £1,487, in addition to which £745 will need to be spent on the necessary mains.

Middlesbrough.—SUB-STATIONS.—The Town Council proposes to erect sub-stations in Hall Drive and Ayresome Road.

LOANS.—Application is being made for sanction to borrow £35,886 for mains, £23,798 for services and £16,736 for meters.

Norwich.—INCREASED COSTS.—The Electricity Committee feels that it will have to consider at an early date passing on to consumers part of the increased costs which now amount to between £45,000 and £50,000 per annum.

Oxford.—LIGHTING SCHEME APPROVED.—The £1,800 lighting scheme which was recently referred back for further consideration has now been approved. It was stated that the portion of London Road concerned was the only part remaining to be lighted to Class C standard.

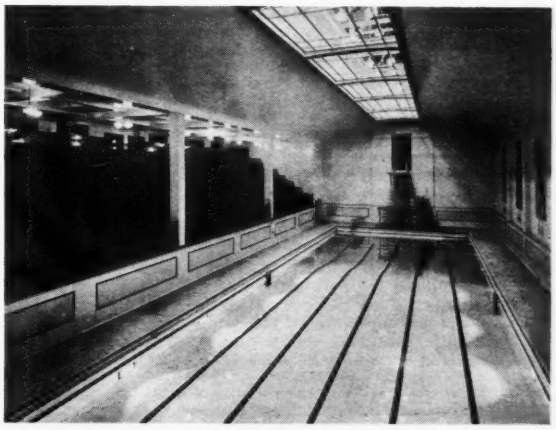
Portland.—LOANS.—The Electricity Committee is seeking sanction to borrow £8,100 for services, meters and consumers' electrical apparatus.

South Shields.—NEW CONTROL ROOM.—The opening of a new control room at West Holborn power station on October 21st marked the end of the second stage in the plan of the Electricity Department to change over the system from 4,000 to 11,000 V. The reorganisation scheme being carried out by the Council is to cost altogether £250,000.

Staveley.—IMPROVED LIGHTING.—Sections of the road in the Hollingwood and Duckmanton wards, Staveley, were illuminated recently for the first time by sodium discharge lamps. In all 150 concrete standards with sodium lamps have been erected.

Stoke-on-Trent.—EXTENSIONS.—The Electricity Committee is to provide a supply to new works in Forge Lane, Etruria, at a cost of £1,600, and install new low-voltage switchgear in ten sub-stations in the Hanley area (£500).

Southend-on-Sea.—ELECTRICITY ESTIMATES.—The Town Council recently referred back a proposal of the Electricity Committee that, with a view to increasing the income of the undertaking for the present financial year by a sum sufficient to meet the estimated deficiency, the rate of discount allowed to electricity consumers on the prompt payment of accounts should be reduced from 5 to 2½ per cent. After reviewing the position the Committee decided to inform the Council that it was unable to recommend that any variation should be made in the tariffs during the present financial year, but that the position would be thoroughly investigated when the revised estimates were presented in December next and again at the end of the financial year. This was approved by the Council.



The main pool of new swimming baths at Finsbury showing the effective lighting. Two rows of "Glassteel" reflectors are equipped with twenty-four 500-W "Osram" lamps, and opal glass panels diffuse the light. G.E.C. 500-W under-water flood-lighting units are installed, and a corridor below the bath surround enables colour effects to be introduced

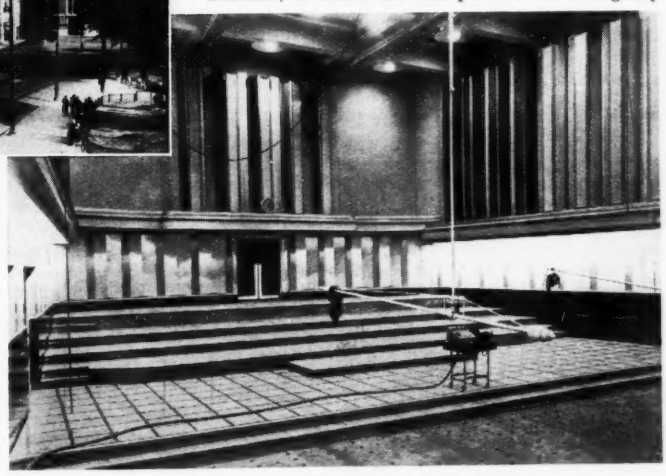
Torquay.—NEW TESTING ROOM.—A new testing department building is to be built for the Torquay electricity undertaking at Newton Abbot.

Wimbledon.—FIXED PRICE SYSTEM WITHDRAWN.—The thirty-three consumers receiving a supply on the fixed price system have been notified of the discontinuance of this system as from the end of last month.

EXTENSION.—The Electricity Committee is to provide a supply to the Kingston housing estate, New Malden.

Communications

Belgium.—NEW BROADCASTING HOUSE.—The Brussels Broadcasting House which has been under construction since 1935 has now been completed, and a Press view was held last week. The official opening will take place later. The building is among the most modern in Europe and contains what is stated to be the largest broadcasting studio in the world. There are eighteen other studios, one of which, of medium size, has forty-eight hexagonal pillars 4½ m. high arranged round the walls, each with three sides of sound-absorbing and three of sound-reflecting material. For rotating the pillars there is an electric motor under each, remotely controlled by push-button, and the pillars can be turned in groups or singly without noise. The tower of the building is intended for a possible television transmitter. The electricity supply is from the public mains, there being two independent cables so that should a fault occur in one the other can be used. In addition, a Diesel set will provide for emergency lighting and the operation of the entire microphone and amplification equipment should there be a total supply failure.



The new Brussels Broadcasting House. Right: A studio which has a special arrangement for varying the acoustic properties

Great Britain.—TELEVISION IN CINEMAS.—In his presidential address to the British Kinematograph Society last week Capt. A. G. D. West said that in the near future televised pictures of current events would be shown on full-sized screens in every cinema. Within the next few years it would be possible to use a complete and satisfactory electronic system in the taking and distribution of moving pictures. The pictures would have the full definition and brilliance demanded by the cinema-going public. It had been found in tests with private audiences that the great attraction was that the result of the event was not known by the audience.

RADIO RELAYS.—It is understood that an announcement will be made by the Government before Christmas regarding the future of radio relays in this country. Relay operators now hold a temporary three-year licence, expiring at the end of 1939, and it is anticipated that new licences will be issued for a ten-year period dating from 1936, in which year the Ullswater Committee reported in favour of the industry being nationalised.

RECEIVING MAST FOR TELEVISION.—The St. Pancras Highways Committee has recommended the Council to approve a drawing submitted by the British Broadcasting Corporation showing details of a 150-ft. ultra-short wave receiving mast for television which the B.B.C. proposes to erect on a site on the north-east corner of Swain's Lane and Bisham Gardens.

AUTOMATIC TELEPHONY.—A new automatic telephone exchange will be opened at Ravensbourne, Bromley, next week.

Tunisia.—NEW TRANSMITTER.—The French Minister of Posts and Telegraphs recently officially opened the new 20-kW Government broadcasting station, Poste Imperial de Djedeida-Tunisien. It operates on a wavelength of 345.6 metres.

United States.—TELEVISION.—A *Reuter* message from New York states that a limited television service to the public is to be started by the Radio Corporation of America. It will extend to at least two hours per week. The company is also planning the manufacture of a restricted quantity of television receivers, which it expects to market by the time the New York World's Fair opens next April.

Traction

Birmingham.—BUSES TO REPLACE TRAMS.—Buses are to take the place of the trams on the Handsworth and Smethwick routes early next year.

Darlington.—TROLLEY-BUS PLANS.—In connection with its trolley-buses the Transport Committee proposes during the next five years to undertake depôt extensions costing £7,000 and alterations to offices (£3,000). A sum of £75,000 is to be spent on replacements and additions to rolling stock, £1,500 on machinery and plant and £10,000 on electrical equipment for route extensions. Consideration is being given to the immediate extension of the trolley-bus route to the junction of Yarm Road and Lingfield Road.

London.—NEW ALDGATE EAST STATION.—On Sunday Aldgate East Station, on the District line, will be closed in order to allow engineers to complete the first stage of the work which will make possible the opening of the platform, the west booking hall and west entrances of the new station east of the existing station. A section of track 1,200 ft. long now supported on 7 ft. trestles will be lowered to the floor of a new tunnel which has been built round the old one.

BOARD'S REPORT.—In its fifth annual report published to-day the London Passenger Transport Board records that the number of journeys originated on its system in the year ended June 30th last, at 3,723.7 millions, established a new record and exceeded the previous year's total by 87.3 millions. Trolley-buses accounted for 10 per cent. of the whole as compared with 6 per cent. in the previous year, but the number of journeys on trams dropped from 25 to 19 per cent. of the total.

Southern Railway.—TRADERS APPEAL FOR ELECTRIFICATION.—The East Grinstead Chamber of Commerce recently issued a strong appeal to the company for electrification, and asked to be allowed to send a deputation to press its claims. The company has, however, replied that no plans other than those already authorised can be considered in the immediate future.

New Switch and Control Room at Finchley

Special safety measures

EVERY precaution against fire has been taken in the design of the new switch house and control room at Finchley power station which was opened on October 22nd by the Mayor of Finchley (Alderman A. T. Pike), supported by the chairman of the Electricity Committee (Councillor J. F. Kneale Caine).

In 1937 the C.E.B. intimated that it proposed to bring a 66-kV supply direct from Islington to Finchley and retain the 6.6-kV supply from Hornsey as a standby. These proposals included the installation of two 0.15-sq. in. 66-kV oil-filled cables from Islington to supply two 15,000-kVA transformers installed near the power station, stepping down to 6.6 kV. The resulting short-circuit power on the station bus-bars would have been in the neighbourhood of 350,000 kVA.

In order to avoid the heavy expenditure involved in replacing both power station and sub-station switchgear and in many instances the rebuilding of sub-stations to deal with it, it was decided to limit the short-circuit power initially to 150,000 kVA by the provision of series reactors in each feeder and a bus-bar section reactor so that the existing feeder circuit-breakers are retained. When, however, the Central Electricity Board decides to bank the two 15,000-kVA transformers on to one 66-kV feeder and provide a 30,000-kVA transformer on the second feeder, and the maximum demand reaches 15,000 kVA (it has already reached 12,000 kVA), the rupturing capacity of all power station circuit-breakers will have to be increased to 250,000 kVA.

Switchgear Layout

The final layout of the equipment is in the form of a "U," the connection between the two arms being tubular bus-bar trunking carried below floor level in a separate bus-bar trench. Between the two arms of the "U" is a central passage with five switch cubicles on each side; each section switch is housed in a separate cubicle.

Fireproof automatic self-closing doors incorporating a fusible link separate each switch cubicle from the central passage, and all dividing walls are "floating" to obviate the risk of an explosion damaging the ceiling which is the floor of the control room. The floor of each switch cubicle is finished in oil-resisting granolithic and is provided with oil drains which connect to an oil pump outside the building, lined with oil-resisting cement and filled with pebbles. Provision is made for pumping any oil or water from this sump.

The compound-filled switchgear is of Reyrolle manufacture. All section and Central Electricity Board switches are of 16,000 A capacity and 350,000 kVA rupturing capacity. The power cables, pilot and control cables pass through the floor of the cubicles into a cable trench below. The short length of cable between the floor and the switchgear is protected by moulded asbestos and there is also a seal between the cubicle and the cable trench which prevents burning oil flowing into the latter. Carbon dioxide automatic fire protection is installed in each cubicle.

The control cables are carried from the cable trench in ducts under the switchroom floor into a trench in the floor of the control passage between the cubicles, whence they pass up vertical ducts into a trench underneath the control panels. Throughout the whole of their route they are protected against fire by heavy stoneware covers on the trenches and "Durasteel" panels on the vertical ducts. All heating and lighting circuits are wired with "Pyrotenax," which was originally introduced for a fire-protected system for power station work, although this is one of the first instances where it has been used for this purpose. Each cubicle is provided with tubular heaters to prevent condensation.

The Control Room

In the control room the panels are arranged in the form of a "U," at one end of which are the tap changing and relay panels and at the other end the metering panels. Four columns in the centre of the control room support a flat reinforced-concrete roof in which pavement lights are fixed. The whole roof can be covered with a double layer of sandbags as precaution against incendiary bombs. Between these four columns are two teak desks, the first of which carries a telephone extension board for communicating with the chief officials. The second desk has two side wings carrying miniature instruments giving feeder voltages and loads and also machine loads. In addition, this desk carries equipment for remote load indication and for controlling the load on Ballards Lane rotary sub-station and also the low-voltage circuit-breakers in six principal sub-stations. The lighting fittings are sunk into the top of the control cubicle and directed on to the roof, giving a uniform light distribution with an absence of reflection on the panels. In the control room all cables are carried in accessible but concealed trenches. A hard wood called "Pinkadoo," which resembles mahogany in graining, has been used for the floor of the control room and mess room. The main station battery is housed in a room immediately above the mess room, and also contains the C.E.B.'s centrovisory battery, metering battery, battery chargers and automatic emergency lighting system for the power station. Many of the control panels were transferred from the old control room to the new site without interrupting the supply.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Varley Dry Accumulators, Ltd.—Private company. Registered October 17th. Capital, £30,000. Objects: To carry on the business of manufacturers of accumulators and primary batteries, electrical components, &c. The permanent directors are: C. Oliver, 3, Shepherds Green, Chislehurst, S. E. Smith, O.B.E., F.S.A.A., "Elm Trees," Thorpe Esplanade, Thorpe Bay, and L. Fuller, E. W. Sudlow, and G. F. N. Oliver, addresses not stated. Registered office: By Pass Road, Barking, Essex.

Ward Electrical Engineering Co., Ltd.—Private company. Registered October 17th. Capital, £1,000. Objects: To acquire the business of electrical engineers and contractors carried on by H. Fuller and L. Budd, as the Ward Electrical Engineering Co., at 155, Wardour Street, W. The permanent directors are: H. Fuller, 82, Lynton Road, N.W.9, L. Budd, 82, Vartry Road, N.15, and A. A. Jacobs, 17, Enmore Gardens, S.W.14. Registered office: 155, Wardour Street, W.1.

Springvale Electrical Co., Ltd.—Private company. Registered October 17th. Capital, £5,000. Objects: To acquire the business of an electrical engineer, contractor and exhibition fitter carried on by G. H. Armitage at Esveelle Works, Springvale Corner, Brentford, as Springvale Electrical Co., Springvale Exhibition Stand Fitting Co., and Springvale Co. The subscribers are: G. H. Armitage, 29, Fitzwilliam House, Richmand, and D'Arcy I. Hamilton, 65, Montrose Avenue, Whitton, Middlesex. G. H. Armitage is permanent governing director Registered office: Esveelle Works, Springvale Corner, Brentford.

R.I. Engineering, Ltd.—Private company. Registered October 17th. Capital, £100. Objects: To carry on the business of manufacturers of and dealers in scientific instruments and appliances, automatic machines and mechanisms, dynamos, motors, magnetos, sound and vision instruments, &c. The subscribers are: J. Joseph, The Beacon, Grovelands Road, Purley, Surrey, and E. J. Fearn, 47, Clarendon Way, Chislehurst, Kent. Secretary: J. Bell, C.A., 46, Victora Street, S.W.1.

James & Co. (Radio), Ltd.—Private company. Registered October 19th. Capital, £100. Objects: To carry on the business of manufacturers, repairers and hirers of and dealers in electrical and mechanical apparatus and accessories and in particular radio sets and valves, gramophones, &c. The directors are: C. D. Percy, 15, Fairway, Raynes Park, S.W.20, and S. H. Cook, 13, Lime Grove, Addlestone, Weybridge. Registered office: 15, Station Buildings, Coombe Lane, Raynes Park, S.W.20.

Home Utilities, Ltd.—Private company. Registered October 19th. Capital, £300. Objects: To carry on the business of manufacturing, importing, dealing in, selling, repairing, and letting out on hire, radio apparatus and component parts, electrical apparatus, &c. The subscribers are: W. A. C. Henderson, 23, Chatterton Road, Finsbury Park, N.4, and E. C. Davis, 36, Whitehall Park, Highgate, N.19. Solicitors: Maxwell, Batley & Co., Cunard House, 88, Leadenhall Street, E.C.3.

Sanda (Electrical), Ltd.—Private company. Registered October 21st. Capital, £100. Objects: To carry on business as electrical, mechanical and general engineers, &c. The subscribers are: R. Shapiro, 68, Finsbury Pavement, E.C.2, and M. Melzack, 31, Foscote Road, N.W.4. Registered office: 68, Finsbury Pavement, E.C.2.

South Wales Aluminium Co., Ltd.—Private company. Registered October 21st. Nominal capital, £500,000. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in aluminium and other metals and metallic combinations of all kinds, &c. The first directors are Lt.-Col. Sir Rhys Williams, Bt., D.S.O., K.C. (chairman), and A. Bloch, E. Kaufmann, Wm. M. Morrison and E. G. MacDowell. Registered office: 1, Oxford Court, Cannon Street, E.C.4.

Walford-Lilley Sales, Ltd.—Private company. Registered October 13th. Capital, £1,000. Objects: To carry on the business of distributors of, dealers in and agents for electrical appliances, fittings, equipment and accessories, hardware, ironmongery, &c. The first directors are F. G. Thompson and G. Lilley, addresses not stated. Solicitors: Moon, Gilks & Moon, 24, Bloomsbury Square, W.C.1.

J. M. Vaughan, Ltd.—Private company. Registered October 10th. Capital, £3,000. Objects: To acquire the business carried on by J. M. Vaughan, electrical engineer, as J. M. Vaughan, at 7, 8 and 9, Triangle South, Clifton, Bristol. The directors are: J. M. Vaughan (permanent), The Gables, Park Road, Keynsham, Somerset, and H. Thorne, 9, Triangle South, Clifton, Bristol. Registered office: 7-9, Triangle South, Clifton, Bristol.

Electro Plastics, Ltd.—Private company. Registered October 12th. Capital, £100. Objects: To carry on the business of manufacturers of and dealers in bakelite and bakelite goods, plastic materials, &c. The directors are: V. H. McGrattan, 135, Rickmansworth Road, Watford, and five others. Solicitors: Sedgwick, Turner & Co., Watford Place, Watford.

Returns of Electrical Companies

John Ismay & Sons, Ltd.—Capital, £300,000 in 200,000 preference shares of £1 and 2,000,000 ordinary shares of 1s. each. Return dated August 25th, 1938. All shares taken up. £254,000 paid (£1 on 90,000 preference, £1 1s. 6d. on 10,000 preference, £1 1s. on 50,000 preference, £1 2s. 6d. on 50,000 preference, 1s. on 265,000 ordinary, 2s. 6d. on 10,000 and 3s. on 200,000 ordinary shares). £36,250 considered as paid on 725,000 ordinary shares. Mortgages and charges, nil.

Herne Bay and District Electricity Supply Co., Ltd.—Capital, £140,000 in £1 shares. Return dated May 27th, 1938. 110,006 shares taken up. £90,006 paid. £20,000 considered as paid. Mortgages and charges, £27,000. A return of allotments made up to July 11th, 1938, shows a further 6,000 ordinary shares allotted.

Lisbon Electric Tramways, Ltd.—Capital, £1,500,000 in 500,000 preference and 1,000,000 ordinary shares of £1. Return dated June 27th, 1938. 425,553 preference and 949,755 ordinary shares taken up. £134,026 paid on 134,026 ordinary shares, £1,241,282 considered as paid on 425,553 preference and 815,729 ordinary shares. Mortgages and charges: £333,300.

"M.K." Electric, Ltd.—Capital, £300,000 in 100,000 preference and 200,000 ordinary shares of £1. Return dated July 20th, 1938. All shares taken up. £768 paid, £299,232 considered as paid. Mortgages and charges: £6,600.

La Plata Electric Tramways Co., Ltd.—Capital, £450,000 in 200,000 preference and 250,000 ordinary shares of £1 each. Return dated July 12th, 1938. All shares taken up. £170,007 paid on 170,007 preference shares, £279,993 considered as paid on 29,993 preference and 250,000 ordinary shares. Mortgages and charges: £78,300.

London Electronics (Machinery), Ltd.—Capital, £40,000 in 12,000 preference and 28,000 ordinary shares of £1. Return dated December 31st, 1937 (filed June 29th, 1938). 8,030 preference and 28,000 ordinary shares taken up. £7,031 paid on 7,030 preference and two ordinary shares, leaving £1 calls unpaid, £28,998 considered as paid on the remainder. Mortgages and charges nil.

Langleys (Kensal Rise), Ltd.—Capital, £2,500 in £1 shares. Return dated May 10th (filed July 15th), 1938. 2,054 shares taken up. £416 10s. paid (£1 on four and 5s. on 1,650 shares), £100 considered as paid on 400 shares. Mortgages and charges nil.

Europe & Azores Telegraph Co., Ltd.—Capital, £200,000 in £10 shares. Return dated May 31st (filed June 10th), 1938. All shares taken up. £144,320 paid. £55,680 considered as paid. Mortgages and charges, nil.

Johnson & Turner, Ltd.—Capital, £2,000 in £1 shares. Return dated July 28th, 1938. 1,000 shares taken up. £700 paid. £300 considered as paid. Mortgages and charges, nil.

S. Hathaway & Co., Ltd.—Capital, £1,500 in £1 shares. Return dated May 20th (filed July 9th), 1938. All shares taken up. £1,500 paid. Mortgages and charges, nil.

Belgrave Electric Co., Ltd.—Capital, £3,000 in 2,800 ordinary and 200 preference shares of £1 each. Return dated September 22nd, 1938. 2,800 ordinary and 160 preference shares taken up. £1,723 paid on 1,563 ordinary and 160 preference, £1,237 considered as paid on 1,237 ordinary shares. Mortgages and charges nil.

Brush Electrical Engineering Co., Ltd.—Satisfaction in full on October 14th, 1938, of (1) trust deed dated September 4th, 1908, and registered September 8th, 1908, and (2) debentures dated February 16th, 1937, and January 6th, April 5th, and May 12th, 1938, and mortgage or charge as additional security dated July 12th, 1938, and registered March 8th, 1937, and January 12th, April 8th, May 14th, and July 30th, 1938, respectively.

City Notes

The Perak River Hydro-Electric Power Co., Ltd., held its annual meeting on October 19th when Mr. G. Balfour (chairman), who presided, said that if they only made exactly the same appropriation for writing down depreciation and reserve as in the previous year the balance of revenue account available for loan interest dividend, &c., would show an increase of £23,000. The directors, however, felt that it was a wise policy to make larger appropriations during the years of heavy tin consumption so that they could feel justified in making more modest appropriation in any lean year or years if they had to face them. They began the financial year with an 80 per cent. Malayan tin quota and finished the year with about a 33 per cent. quota, the load falling from 42,900 kW to 27,000 kW. It must be remembered, however, that the load in excess of their hydro-electric capacity which had to be served by the steam plants did not carry the same margin of profit. In the year ended July, 1936, the coal bill was £41,000, in 1937 £109,500 and last year £61,000, the difference, amounting to £48,500, being entirely due to the drop in load during the last half-year. They could assume that they were now facing the low level of demand for tin and that the trend of world trade would be steadily and firmly on the upgrade, so that they might expect considerable improvement during the current financial year. They sold 214,000,000 kWh last year, as compared with 228,000,000 kWh in the preceding year, a decrease of 14,000,000 kWh. On the maximum load they had to work all their plant, both hydro-electric and steam, to full capacity. Any increase in demand would have exceeded their available generating capacity as the additional steam plant in the Batu Gajah station would only be ready for service in a month or two. With the completion of this plant they would be prepared for any load they were likely to have to deal with for some years to come. They could look forward, after the balance of payment for the work now nearing completion had been made, to no very heavy capital commitments for some time to come. With regard to the proposal to increase the capital by the creation of 500.000 "A" shares of £1 each, they did not anticipate that they would require to issue more than one-half of the amount to be authorised to cover fully the balance of all their capital commitments outstanding. A pension scheme for their European employés in Malaya was inaugurated in August last. Following the annual meeting a resolution was carried authorising an increase of capital to £3,500,000 by the creation of 500,000 new shares of £1 each.

Ferranti, Ltd., report a net profit for the year ended June 30th of £68,263, after making provision for general establish-

ment charges, bad debts, repairs and renewals, income tax and N.D.C., depreciation, &c., as compared with £64,923 in the preceding year, to which is added £56,395 brought in. General reserve receives £15,000, and it is proposed to pay a dividend of 6 per cent. for the year on the ordinary stock (same), leaving £56,658 to be carried forward. Meeting: October 28th.

Ensign Lamps, Ltd., reports a profit for the year ended June 30th of £31,352, as compared with £13,963 for the preceding six months, to which is added bank interest (£88) and transfer fees (£44), making £31,484. From this are deducted director's fees £500, and N.D.C. £1,549, and after adding £6,451 brought in, there is a balance of £35,886 available. The final ordinary dividend is 15 per cent., making 25 per cent. for the year, general reserve receives £5,500, and £11,446 is carried forward.

Telcalemit, Ltd., reports a profit for the year ended July 31st of £114,001, as compared with £100,112 in the previous year, and a net profit of £72,451 (against £62,070). It is proposed to increase the dividend for the year on the enlarged capital from 16 per cent. to 18 per cent., and to carry forward £15,581 (against £14,383 brought in).

Herbert Morris, Ltd., report that after allowing for taxation and placing £22,483 to depreciation fund, the net profits for the year ended July 31st were £180,143, as compared with £150,910 in the preceding year, to which is added £50,224 brought in. It is proposed to pay a final dividend of 27½ per cent. (against 25 per cent.) on the ordinary shares, making 32½ per cent., tax free, for the year (against 27½ per cent.), to place £20,000 to reserve and to carry forward £70,367.

Crabtree Electrical Industries, Ltd., has declared a final ordinary dividend of 5 per cent. and a cash bonus of 7½ per cent., less tax, making 17½ per cent. for the year (same).

The Anglo-Portuguese Telephone Co., Ltd., is maintaining its interim dividend at 3 per cent., less tax.

Burco, Ltd., has announced a final dividend of 12½ per cent. and a bonus of 2½ per cent., making a total distribution of 22½ per cent. for the year (against 20 per cent.).

The Ever Ready Co. (Great Britain), Ltd., is maintaining its interim dividend on the ordinary stock at 15 per cent., actual.

The Scottish Power Co.—The subscription list for the issue of 500,000 4 per cent. £1 preference shares which opened on October 20th was closed on the same day, being largely oversubscribed.

Broadcast Relay Service, Ltd., has declared an interim dividend of 5 per cent., less tax (same).

The Urban Electric Supply Co. is paying an interim dividend of 4 per cent. on £175,000 capital (against 3 per cent. on £700,000 capital).

The Anglo-American Telegraph Co. has announced quarterly dividends of 15s. per cent. on the ordinary stock and £1 10s. per cent., on the preferred ordinary stock (unchanged).

Stocks and Shares

TUESDAY EVENING.

FOUR weeks have passed since the war crisis became acute on Wednesday, September 28th, and the Stock Exchange may now be said to have settled down into more normal conditions. The War Loan, which fell at that time to 90, has recovered to 99, ex the interest due on December 1st next. Violent recoveries have taken place in the prices of stocks and shares which gave way so heavily a month ago. Confidence and capital are returning by degrees.

One of the latest features in Stock Exchange markets is an all-round rise in iron, coal and steel shares. Accompanying this have come advances in the shares of companies connected with engineering and allied industries. The industrial position in America shows unmistakable signs of improvement and the tendency of American prices has been decidedly bullish. This exercises an indirect influence over British stocks and shares.

The war in the Far East seems to be drawing to its conclusion. At home, there is a hopeful feeling that industry will recover from its late reaction. In short, the atmosphere may be described as cautiously cheerful. For the moment, income-tax increases are relegated to the background.

Cross-currents in Gilt-edged Stocks

Animation in the gilt-edged market is scarcely to be expected so long as the financial demands of the bigger national defence programme overshadow the prospect. As matters stand now, the buyer of War Loan at a point under par receives a net income of little more than 2½ per cent., after deduction of income tax. Another sixpence on the latter would make the return look undeniably meagre. With many people this aspect of the situation seems to carry more weight than does the possibility of prices being depressed by the appearance of new Government loans. Nervousness on this score is mitigated by confidence in the powers of the authorities to support the market during a period when cheap borrowing would save the Treasury millions of money in interest. The market has done a little better than merely hold its ground during the week. Declines of half a point to a point in Central Electricity Board 5 per cent. stock, 1950/70, at 110½, London Transport Board "A" 4½ per cent., at 115½, and London and Home Counties 4½ per cent., at 109½, are exceptional.

Electricity Supply

The Electricity Commissioners' report for the year ended last March provides points of interest for the otherwise slow market in electricity supply shares. A 12 per cent. increase in the year's output of current is well to the market's liking, particularly since this was achieved in the face of a marked deceleration towards the end of the year. That the industrial recession should have left some mark on the electricity consumption figures is not considered as detracting from the investment merits of the companies' shares. It is regarded as achievement enough that the output continues to grow healthily, while most other forms of production show signs of wilting. Price movements among the home electricity companies are insignificant. Among the overseas companies, Palestine "A" shares rallied from 27s. to 29s. 6d. on the measures to restore discipline in the country. Perak Hydros remained at £1 after the meeting. A jump of 5 points, to 57½, in Tokyo Electric six per cent. bonds followed news of the Japanese military successes.

Scottish Power Issue

With last week's offer of half a million £1 preference shares at par, the Scottish Power Company was the first to test the investor's post-crisis attitude to new issues. The result was a complete success, subscription lists being open for no more than five minutes and the applications being for double the number of shares available. Success in the case of an issue of nearly gilt-edged standing is not regarded, however, as necessarily the forerunner of livelier times in the new issue market. It is looked upon rather as a sign that investment continues to think on safety-first lines, and that there is a great deal of money ready to accept a moderate rate of interest in return for a high degree of security. Considerable doubts exist as to how an offer of industrial ordinary shares would fare at the hands of the public in its present mood. The matter will be put to the test within a week.

The New Shares

Dealings in the new Scottish Power preference shares opened on Monday of this week at a premium of 4½d. over the prospectus price of £1. This brings the shares into line with the existing 4 per cent. preference stock, with which the new capital will rank equally in all respects. Also of equal standing is the company's 6 per cent. preference, which is quoted at the relatively cheaper price of 29s. 6d., the yield being £4 1s. 4d. per cent. against £3 18s. per cent. on the four per cents. at 20s. 6d. The discrepancy is a good example of the slight chariness shown towards electricity supply companies' preference shares which stand some way above the price of possible repayment. Profits earned last year by the company were about five times greater than the requirements of the preference stocks—the company's first capital charge.

Cable and Wireless Traffics

Consideration of last month's unpleasantly hectic flow of communications takes the gilt off the strong showing of the Cable and Wireless traffics index for September. At 71.3, the figure is more than 11 points up on August, although still more than a point lower than a year ago. For the first three-quarters of the year the average receipts are nearly 11 per cent. less than those for the corresponding nine months of 1937. That no one was misled by the September traffics into false optimism is evidenced by the small and irregular movements in the combine's stocks, the ordinary at 44½ being 10s. better, and the preference at 88½ a similar amount down. Globe Telegraph ordinary have gone back from 30s. to 27s. 6d.

Equipment and Manufacturing

Callender's Cable and Crompton Parkinson shares have partially recovered from the disappointment which followed the breaking-down of negotiations for a partnership between the two companies. Both prices are half a crown up, at 4⅞ and 26s. 3d. respectively. Lancashire Dynamos also gained 2s. 6d., to 57s. 6d. General Electrics and several of the other leaders reflect a more cheerful feeling in the industrial markets. Ensign Lamps have firmed up to 14s. 3d., ex dividend, since the good dividend announcement. Ever Ready is paying 15 per cent. interim dividend, the same as that of last year, but this time on a larger number of shares. The price has improved from 19s. to 20s.

Miscellaneous Matters

The market in steel and engineering shares came to life with suddenness on Friday of last week. Prices of the leading shares rose by anything up to half a crown during the day, and carried the movement on into the present week. It seems that a fair demand found very little stock on offer. Holders are showing reluctance to part from their shares in view of the promise of the heavy industries' position. Vickers were well to the front with a rise of 3s. 6d., to 25s. Hopkinsons, at 38s. 9d., and Mather & Platt, at 46s. 3d., are each 1s. 9d. to the good. British Aluminium have gone ahead from 50s. to 53s. Continued activity in Wall Street has moved many prices to the highest levels of the year, utility stocks again being in the lead. Radio Corporations have been a good feature with a rise of 1¼, to 9¼. This has had a bearing on the rise in Electrical & Musical Industries from 10s. 3d. to 12s. In the home transport group, London Transport Board "C" stock, at 77, has gathered further strength from the idea that fares on the bus services will be raised. An advance of 4 points in Southern preferred, at 55½, speaks for the more hopeful air in the home railway market. The rubber share market remains inanimate.

Electrical Companies' Shares

Prices, dividends and yields

Company	1938. High-est.	1938. Low-est.	Dividend. Pre-vious.	Dividend. Last.	Price Oct. 25.	Rise or Fall.	Yield p.c. £ s. d.
Home Electricity Companies.							
Bournemouth and Poole...	68/3	62/–	15	15	67/6	—	4 8 7
British Power & Light ...	30/9	24/6	6	7	28/6	—	4 18 3
City of London	34/6	28/6	7½	7½	31/6	—	4 15 3
Clyde Valley	42/6	33/–	8	8	35/9	—	4 9 4
County of London ...	51/9	38/9	10½	10½	46/–	–6d.	4 11 5
Edmundson's :							
7% Pref.	33/3	30/–	7	7	32/–	—	4 7 6
Ord.	40/9	18/9	9	9	25/6	—	—
Elec. Dis. Yorkshire ...	43/6	37/9	9	9	42/6	—	4 4 8
Elec. Fin. and Securities...	51/9	49/–	12½	12½	50/–	—	5 0 0
Elec. Supply Corporation...	55/–	50/–	12	12	53/9	—	4 9 5
Isle of Thanet	21/3	18/6	4	4	20/–	—	4 0 0
Lancs Light and Power ...	35/–	26/–	7½	7½	31/3	—	4 16 0
Llanelly Elec.	23 6	21/–	5½	5½	21/6	—	5 2 4
Lond. Assoc. Electric ...	32/9	28/–	7	7	30/9	—	4 11 4
London Electric	36/3	32/–	8	10	34/–	—	4 2 4
London Power Deb. Red.	108¾	100	5	5	105	—	4 15 3
Metropolitan	51/–	41/–	10	12	47/6	—	5 1 1
Midland Counties	39/9	33/–	8	8	37/6	—	4 5 3
Mid. Elec. Power	41/9	37/–	8	9	40/–	—	4 10 0
Newcastle Elec.	31/9	27/6	7	7	28/9	–⅛	4 17 4
North Eastern Electric :							
Ordinary	34/–	25/–	7	7	31/–	—	4 10 6
7% Pref.	34/–	30/–	7	7	32/–	—	4 7 6
Northampton	47/6	43/9	10	10	46/3	—	4 6 7
Notting Hill 6% Pref. (£10)	14	13½	6	6	13½	—	4 9 0
North Met. Elec. :							
Ordinary	49/–	43/–	10	10	47/6	—	4 4 3
6% Pref	30/6	28/3	6	6	30/–xd.	—	4 0 0
Richmond Elec.	30/6	28/–	7	7	28/9	—	4 17 5
Scottish Power	38/9	32/–	8	8	36/3	—	4 8 2
Southern Areas	22/9	18/6	4½	5	21/3	—	4 14 1
South London	32/6	31/–	7	7	31/6	—	4 9 0
West Devon	23/3	21/3	5	5	1½	—	4 9 0
West Glos.	19/–	16/9	2	2	18/–	—	2 4 5
Yorkshire Elec.	42/–	36/9	8	8	40/–	—	4 0 0
Overseas Electricity Companies.							
Atlas Elec.	4/6	2/6	Nil	Nil	3/–	–3d.	—
Calcutta Elec.	44/3	36/3	12*	10*	1¼	—	5 6 8
Cawnpore Elec.	40/–	35/–	10	10	36/3	—	5 10 6
East African Power ...	28/3	22/6	7	7	26/–	—	6 5 0
Jerusalem Elec.	26/9	23/3	5	6	24/–	–1/–	5 0 0
Kalgoorlie (10/–)	12/–	9/6	7½	7½	10/9	—	6 19 6
Madras	34/6	28/9	8*	8*	30/–	—	5 6 8
Montreal Power	31¾	26¾	1½	1½	31½	–½	—
Palestine Elec. "A" ...	31/9	27/–	7½*	7½*	29/6	+½	5 1 8
Perak Hydro-electric ...	25/3	17/–	7	6	20/–	—	6 0 0
Shawinigan Power ...	23½	16½	65cts.	85cts.	21½	–¾	—
Tokyo Elec. 6%	65½	39	6	6	57½	+5	10 8 6
Victoria Falls Power ...	76/3	55/–	12	13½	71/3	—	3 15 7
Whitehall Investments Pref.	22/3	15/–	7½	7½	18/9	—	8 0 0
Public Boards.							
Central Electricity :							
1950–70	115¾	97	5	5	110½	–½	4 10 6
1955–75	118½	100	5	5	112½	—	4 9 0
1951–73	111	95	4½	4½	109½	—	4 2 2
1963–93	101	85	3½	3½	97½	—	3 11 10
London Elec. Trans. Gtd.	93½	88	2½	2½	91½	—	2 14 8
London & Home Counties,							
1955–75	112¾	97½	4½	4½	109½	–½	4 2 2
Lond. Passenger Transport :							
A	110½	110	4½	4½	115½	–1	3 18 0
B	122¾	105	5	5	116½	—	4 5 10
C	84	68	4¼	4	77	+1	5 4 0
West Midlands Joint Elec.,							
1948–68	115¼	102½	5	5	110½	—	4 10 6
Telegraph and Telephone.							
American Tel. & Tel. ...	154½	114	9	9	155½	+1	5 15 9
Anglo-Am. Tel. :							
Pref.	115¼	103	6	6	104¼xd.	—	5 14 10
Def.	28	24	1½	1½	23	–2	6 10 5
Anglo-Portuguese ...	23/6	19/3	8	8	21/3xd.	—	7 10 7
Cable & Wireless :							
5½% Pref.	104	84	4½	5½	88½	–½	6 4 4
Ord.	67¾	36	—	4	44½	+½	8 19 10
Income	102½	99	—	—	101	—	3 18 2
Canadian Marconi $1 ...	6/6	3/9	—	Nil	5/3	+3d.	—
Globe Tel. & Tel. :							
Ord.	32/6	27/6	5½*	7½*	27/6	–½	5 9 1
Pref.	27/6	23/9	6	6	26/3	—	4 11 5
Great Northern Tel. (£10)	42½	34/–	20	20	41	—	4 17 7
Marconi-Marine	30/6	21/6	10	7½	23/9	—	6 6 4
Oriental Telephone Ord. ...	59/3	2½	12*	12*	52¾xd.	–2/–	4 7 3
Radio Corpn.	8	4½	8	6	9½	+1½	—
Telephone Props	13/9	11/3	5	6	13/9	—	8 14 6
Telephone Rentals (5/–) ...	10/–	7/6	5	6	9/3	+3d.	3 4 10
Western Union	34½	17	2½	—	31½	—	—
Traction and Transport.							
Anglo-Arg. Trams :							
First Pref.	11/–	2/6	Nil	Nil	3/9	—	—
4% Inc.	31	8	Nil	Nil	8	—	—
British Electric Traction :							
Def. Ord.	1060	675	5	5	950	+25	—
Pref. Ord.	175	150	8	8	165	—	4 17 0
Bristol Trams	45/–	34/3	5	8	38/9	—	4 2 9
Brazil Traction	14½	7⅞	70 cts.	$1	12½	–1	—
Calcutta Trams	26/9	21/6	8	8	23/–	—	6 19 2
Cape Elec. Trams ...	18/6	15/6	5	6	17/6	—	6 17 2
Lancs Transport	35/3	29/3	10	10	32/6	—	6 3 1
Mexican Light :							
1st Bonds	39	16½	5	5	20	—	—
Rio 5% Bonds	91	47	5	5	63	—	7 18 9
Southern Rly. :							
5% Prefd.	87	48	5	—	55½	+4	—
5% Pref.	116	83	5	5	96½	+2	5 3 10
T. Tilling	60/–	36/6	10	10	43/9	—	4 11 4
Tilling & B.A.	57/–	46/–	6	10	50/–	—	4 0 0
West Riding	46/3	30/6	10	10	32/6	—	—
Equipment and Manufacturing.							
Aron Electricity Ord. ...	40/3	31/–	15	15	1 11	—	8 17 6
Assoc. Elec. :							
Ord.	45/3	32/–	10	10	38/–	+6d.	5 5 3
Pref.	38/9	35/6	8	8	36/–	—	4 9 0
Automatic Telephone & El.	43/–	35/–	5	10	41/3	—	4 17 1
Babcock & Wilcox ...	44/–	32/6	10	10	37/6	—	5 6 8
British Aluminium Ord. ...	54/–	40/–	10	12½	53/–	+3/–	4 14 4
British Insulated Ord. ...	95/9	77/–	20	20	4½	—	4 9 0
British Thermostat (5/–) ...	15/6	9/–	17½	18½	11/3	—	8 4 6
British Vacuum Cleaner...	35/9	27/6	5	6	28/3	–1/9	4 5 0
Brush Ord.... ...	5/6	4/9	Nil	Nil	4/9	–3	—
Callender's	5½	78/6	20	20	4	+½	4 15 8
Chloride Elec. Storage ...	77/9	61/–	15	20	75/–	—	5 6 8
Consolidated Signal ...	116/–	75/–	30	36½	4½	—	8 2 0
Crabtree (10/–)	29/–	22/–	—	17½	23/9xd.	+6d.	7 7 6
Crompton Parkinson :							
Ord. (5/–)	32/3	18/9	12½	12½	26/3	+½	—
E. K. Cole (5/–)	8/9	4/6	5	10	6/6	—	7 13 10
Elec. & Musical Industries							
(10/–)	16/3	9/–	10	5	12/–	+1/9	4 3 4
Electric Construction ...	36/–	31/–	10	12½	32/6	—	7 13 10
Enfield Cable Ord. ...	5	46/–	25	25	2½	—	—
Electrical Switchgear ...	26/3	22/6	5	5½	23/9	—	4 12 5
English Electric	31/9	24/6	Nil	10	29/6	—	6 15 7
Ensign Lamps (5/–) ...	14/3	11/3	—	25	14/3xd.	+⅛	8 16 0
Ericsson Tel.	2	31/–	25*	25*	2	—	3 2 6
Ever Ready (5/–)	26/3	16/6	45	35	20/–	+1/–	8 15 0
Falk Stadelmann	34/3	27/–	10	10	27/6	—	7 5 6
Ferranti Pref.	27/6	25/6	7	7	27/6	—	5 2 0
G.E.C. :							
Pref.	34/–	31/3	6½	6½	31/3	—	4 3 4
Ord.	79/3	67/–	17½	20	76/6	+6d.	5 4 9
Greenwood & Batley ...	25/6	19/–	7	15	22/6	—	13 6 8
Hall Telephone (10/–) ...	24/6	18/3	5	15	18/9	—	8 0 0
Henley's (5/–)	21/–	16/–	15	20	20/–	—	5 0 0
4½% Pref.	23/–	22/–	4½	4½	22/6	—	4 0 0
Hopkinsons	40/–	32/6	10	12½	38/9	+1/9	6 8 10
India-Rubber Pref. ...	21/9	20/3	5½	5½	21/3	—	5 3 6
Intl. Combustion	5½	4½	5	30	5	—	6 0 0
Ismay Industries (5/–) ...	6/9	1/3	6	6	1/6	—	—
J. Lucas	57/9	47/6	15	15	56/3	+⅛	5 6 9
Johnson & Phillips ...	43/9	32/6	10	12½	37/6	—	6 13 4
Lancashire Dynamo ...	72/3	53/–	20	25	57/6	+½	8 2 4
Laurence Scott (5/–) ...	12/–	9/–	7	15	11/3	+9d.	6 13 4
London Elec. Wire ...	35/–	28/3	12	7½	28/9	—	5 4 2
Mather & Platt	49/–	41/3	12	13½	46/3	+1/9	5 17 0
Metropolitan Elec. Cable Pf.	22/–	21/–	5½	5½	21/3	—	5 3 6
Murex	93/9	66/3	20	20	72/6	—	5 10 6
Pye Deferred (5/–) ...	12/–	8/–	5	25	9/6	+6d.	13 3 2
Revo (10/–)	36/3	30/–	12	17½	33/9	—	5 3 7
Reyrolle	62/6	49/–	12½	12½	56/3	—	4 9 0
Siemens Ord.	31/–	20/6	7½	7½	23/9	—	6 6 4
Strand Elec. (5/–)... ...	6/–	4/–	5	5	4/6	—	11 2 0
S. Smith (1/–)	9 9	6 3	37½	50	8/9	—	6 6 0
Switchgear & Cowans (5/–)	19/6	12/6	20	20	14/6	—	6 18 0
Telegraph Condenser (10/–)	18/9	12/–	5	5	12/6	—	4 0 0
Telegraph Construction ...	2½	36/–	7½	10	2½	—	4 9 0
Telephone Mfg. (5/–) ...	9/9	7/–	9	9	8/9	—	5 2 10
Tube Investments ...	89/6	70/–	23½	23½	83/3	+9d.	5 14 6
Vactric (5/–)	9,9	5/9	10	10	5/–	–2/–10	0 0
Vickers	27/–	17/6	10	10	25/–	+3/6	4 0 0
Westinghouse Brake ...	63/9	45/–	15	17½	2	–⅛	6 16 2
Walsall Conduits (4/–) ...	26/–	22/6	6½	55	23/3	—	9 9 8
West, Allen (5/–)	5/9	4/6	—	7½	5/6	—	6 16 4

* Dividends are paid free of Income Tax.

New Patents

Electrical specifications recently published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 23, Southampton Buildings, London, W.C.2.

1937

1977. "Control systems for the selective connection of electric rectifiers to load circuits." S. A. Stevens, and Westinghouse Brake & Signal Co., Ltd. January 22nd, 1937. (492744.)

2188. "Arrangements for regulating current and voltage in electric current convertors." Siemens-Schuckertwerke Akt.-Ges. January 24th, 1936. (492807.)

2189. "Moving-contact electric current convertors." Siemens-Schuckertwerke Akt.-Ges. January 24th, 1936. (Addition to 492369.) (Cognate application 2190/37.) (492887.)

2675. "Methods of and arrangements for television transmission with an electronic tube as image disintegrator." Radioakt.-Ges. D. S. Loewe. January 29th, 1936. (Cognate application 2677/37.) (493043.)

2676. "Cathode-ray tube arrangement for television." Radioakt.-Ges. D. S. Loewe. March 3rd, 1936. (492961.)

5588. "Electric indicating systems." British Thomson-Houston Co., Ltd. February 4th, 1936. (492752.)

5653. "Scanning arrangements for television and like systems." Telefunken Ges. für Drahtlose Telegraphie. February 25th, 1936. (492753.)

5821. "Insulation of high-frequency electric conductors." Standard Telephones & Cables, Ltd., and A. A. New. February 25th, 1937. (492890.)

5990. "Variable resistances, condensers, or inductances." Steatit-Magnesia Akt.-Ges. February 29th, 1936. (492809.)

8627. "Galvanic cells." A. Kunze. April 30th, 1936. (492964.)

8895. "Opaque containers and specific gravity indicators for electric storage batteries or accumulators." Oldham & Son, Ltd., and T. G. Mair. March 25th, 1937. (492897.)

8899. "Electric heating units, and utensils for use in association therewith." R. H. Rogers. March 25th, 1937. (Cognate applications 13291/37 and 4981/38.) (492898.)

8958. "Electric fuses of the enclosed type." V. Hope. March 30th, 1937. (493100.)

8966. "Protecting metal surfaces by electro-deposition." Crosse & Blackwell, Ltd., C. G. Sumner, R. I. Johnson, and W. Clayton. March 30th, 1937. (Cognate application 7732/38.) (492900.)

8981. "Methods of modulating carrier-waves." Baird Television, Ltd., and T. C. Nuttall. March 30th, 1937. (493048.)

8983. "Television and like systems." Baird Television, Ltd., P. W. Willans and T. C. Nuttall. March 30th, 1937. (493049.)

8985. "Methods of amplifying electrical signals." Baird Television, Ltd., and P. W. Willans. March 30th, 1937. (493050.)

9036. "Radio-frequency selector apparatus." H. Dent and C. E. Osmond. March 30th, 1937. (493102.)

9039. "Tuning indicators and dials for radio and like apparatus." Marconi's Wireless Telegraph Co., Ltd. March 28th, 1936. (493056.)

9063. "Electric immersion heaters." British Thomson-Houston Co., Ltd., W. J. Sims, and J. H. Fella. March 30th, 1937. (493060.)

9071. "Automatic switches as used in telephone or like systems." Automatic Telephone & Electric Co., Ltd., and D. Wright. March 30th, 1937. (493062.)

9095. "Electrothermic production of compact metallic magnesium by reduction of oxidic magnesium compounds." American Magnesium Metals Corporation. April 2nd, 1936. (493064.)

9130. "Electro-deposition of metals." A. R. Thomas. March 31st, 1937. (499108.)

9225. "Automatic switches for use in telephone or like systems." Automatic Telephone & Electric Co., Ltd., R. Taylor, and G. T. Baker. March 31st, 1937. (493068.)

9302. "Electrical condensers." Standard Telephones & Cables, Ltd., J. A. Leno, and J. C. Edwards. April 1st, 1937. (493070.)

9399. "Electrical precipitators." Lodge-Cottrell, Ltd. (International Precipitation Co., Inc.). April 2nd, 1937. (493116.)

9431. "Circuit arrangements for connecting a number of high-frequency induction furnaces to a common source of supply." R. H. Black, J. R. Spanswick, and Electric Furnace Co., Ltd. April 2nd, 1937. (492763.)

9435. "Electric switches particularly for the control of an electric refrigerator." British Thomson-Houston Co., Ltd. April 3rd, 1936. (493117.)

9539. "Emergency lighting and power means." Batteries, Ltd., and G. H. Dowsett. April 5th, 1937. (492908.)

9820. "Impulse transmitters of the type used in telephone systems." General Electric Co., Ltd., and C. C. Puckette. April 6th, 1937. (492818.)

10060. "Omnibus-bar electric distribution system." Marryat & Place, Ltd., and R. A. Marryat. April 8th, 1937. (493087.)

10079. "Electrical couplings of the plug-and-socket type." J. A. Crabtree & Co., Ltd., H. F. McLoughlin, and B. G. Harrison. April 9th, 1937. (492912.)

10102. "Electric-lamp holders." J. B. Tucker. April 9th, 1937. (492913.)

10969. "Electric fires or radiators." H. H. Berry and G. J. Berry. April 16th, 1937. (492916.)

11402. "Mountings for dynamo electric machines." British Thomson-Houston Co., Ltd. April 21st, 1936. (Addition to 442904.) (492826.)

12477. "Electric photoflash lamps." British Thomson-Houston Co., Ltd., and H. H. Needham. May 1st, 1937. (492773.)

12484. "Electrical connections." R. H. Baker and C. W. Parsons. May 1st 1937. (492975.)

13984. "Change-over electric switch devices." J. Cruwys, J. P. Keith, and G. Richardson. May 19th, 1937. (492979.)

14425. "Manufacture of electric cables." Callender's Cable & Construction Co., Ltd., T. L. Osborne and R. S. Vincent. May 24th, 1937. (492833.)

14599. "Electron-discharge valves." H. A. Malpas. May 26th, 1937. (492983.)

14749. "Means for protecting sheaths of electric cables, pipes, and other metal articles against corrosion." Callender's Cable & Construction Co., Ltd., T. L. Osborne and H. J. Allcock. May 27th, 1937. (492834.)

14852. "Thermionic-valve circuits." Standard Telephones & Cables, Ltd. July 1st, 1936. (492984.)

15539. "Electric-discharge lamps." General Electric Co., Ltd. (Patent Treuhand-Ges. für Elektrische Glühlampen). June 4th, 1937. (492988.)

16950. "Bridge contacts and fuse carriers for electric fuses." Sykes & Dyson, Ltd., P. Sykes, and F. J. Griffith. June 18th, 1937. (492997.)

18064. "Electrically heated pressing-irons." R. G. Boardman. June 29th, 1937. (492999.)

20208. "Extensible electrical conductors." Etablissements J. Chomat et F. Dansard. January 5th, 1937. (492783.)

21697. "Image dissector." Farnsworth Television, Inc. August 18th, 1936. (493007.)

23303. "Cathode-ray tubes." Marconi's Wireless Telegraph Co., Ltd. September 14th, 1936. (493010.)

23822. "Device comprising a gas-filled electric-discharge tube and material excited to luminescence by the discharge." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 3rd, 1936. (492843.)

26622. "Systems controlled by means of devices sensitive to the direction of propagation of radio electro-magnetic waves." Standard Telephones & Cables, Ltd. November 4th, 1936. (492927.)

28142. "Electric welding systems." British Thomson-Houston Co., Ltd. October 16th, 1936. (492930.)

28802. "Method of and machine for making electrodes for electric arc-welding." Holding Intercito Soc. Anon. April 9th, 1937. (493015.)

32253. "Electro-metrical measuring apparatus." Siemens & Halske Akt.-Ges. November 23rd, 1936. (Cognate applications 32254/37 and 32255/37.) (492936.)

34908. "High-voltage discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. December 16th, 1936. (492942.)

36132. "Gas-blast electric circuit-breakers." Akt.-Ges. Brown, Boveri & Cie. December 30th, 1936. (492944.)

1938

2507. "Electrolytic condensers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. January 29th. 1937. (492950.)

3957. "Shaft packings for the casings of electrical machines or apparatus." Siemens-Schuckertwerke Akt.-Ges. February 8th. 1937. (492954.)

7641. "Vibratory electric motors." C. H. Naylor. March 11th. 1938. (493021.)

9103. "Mercury and other sealed-container switches." A. Cianchi. February 24th, 1937. (Divided out of 490946.) (492802.)

10321. "Radio communication systems." Marconi's Wireless Telegraph Co., Ltd. April 3rd. 1937. (493026.)

10730. "Direction-finding radio receiver systems." Telefunken Ges. für Drahtlose Telegraphie. April 7th, 1937. (Addition to 467785.) (493027.)

12633. "Electric irons." British Thomson-Houston Co., Ltd. April 28th. 1937. (493029.)

15144. "Manufacture of the casings of electrical machines." Siemens-Schuckertwerke Akt.-Ges. September 4th, 1937. (492883.)

16570. "Electric-discharge lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 5th, 1937. (493037.)

Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from October 19th:—

Isolector. No. 587020. Class 13 (III). Metal-clad hand-operated switches for electric power switches.—Whitehead Switchgear and Inventions, Ltd., Ferry Road, Cardiff.

Champion Extra Range Sparking Plugs (lettering and design). No. 600627. Class 7 (IV). Sparking plugs.—Champion Sparking Plug Co., Ltd., Great South West Road, Feltham, Middlesex.

Namron. No. 600011. Class 9 (IV). Insulated wire for electrical purposes.—The Scott Insulated Wire Co., Ltd., Queensland Works, Westmorland Road, Queensbury, N.W.9.

Cerelux and Cereluxa. Nos. 600419 and 600420. Class 11 (IV). Carbons for electrical purposes.—Charles Champion & Co., Ltd., National House, 60-66, Wardour Street, W.1.

French Marking Order

As from November 2nd an indication of the country of origin will be required on domestic electrical heating apparatus, electric irons, vehicle direction indicators and windshield wipers imported into France. Additional words such as "Made in," &c., are not required, but are permissible.

Contract Information

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Argentina.—(BUENOS AIRES).—November 21st. National Sanitation Works Department. 1,340 electricity meters. (T.Y. 27794/38.)*

Ashington.—U.D.C. Erection of five street-lighting units with mercury-vapour horizontal burning lamps, &c. R. Dodds, engineer and surveyor, Council Offices.

Australia.—BRISBANE.—November 18th. Tramways and Power House Department. Sets of 11-kV, three-phase, 50-cycle switchgear. (T.Y. 27518/1938.)*

November 22nd. Posts and Telegraphs Department. Lead-covered cable. (T. 28018/38.)*

GLADSTONE.—November 23rd. Electricity Authority. One 200-kVA and one 100-kVA alternator. (T. 28027/38.)*

Bedford.—November 18th. Electricity Department. Meters, waterheaters, cookers, cooker control units, kettles, meter boards and house service fuses for twelve months. (October 21st.)

Birkenhead.—November 15th. Electricity Department. Extra-high-voltage and low-voltage cable and electricity meters for twelve months. (See this issue.)

Birmingham.—November 23rd. Electric Supply Department. All-insulated switch-fuses for twelve months. (See this issue.)

Blackpool.—October 31st. Electricity Department. 6,600-V, three-phase, metal-clad switchgear, and 6,600-V, three-phase transformers. (October 14th.)

November 15th. Borough Council. Electrical installation at the Derby Bath. (See this issue.)

Bognor Regis.—November 7th. U.D.C. Installation of electric lighting in 383 houses. (See this issue.)

Cardiff.—November 14th. Electricity Department. 40-W and 60-W gas-filled lamps. (October 14th.)

Dewsbury.—November 8th. Electricity Department. Low-voltage underground cables for twelve months. (See this issue.)

Edinburgh.—November 7th. Managers of the Royal Edinburgh Hospital for Incurables. Electrical and heating work at the nurses' home. J. Douglas Miller, architect, 30, Walker Street (deposit £1 1s.).

Fife.—November 7th. County Council. Electric lighting at forty houses at Lumphinnans (deposit £1 1s.).

November 7th. Electric lighting at thirty-six houses at Wellwood, Dunfermline. County Clerk, Cupar, Fife (deposit £1 1s.).

Halifax.—November 14th. Housing Committee. Electrical installation work at the Backhold Lane and Nursery Lane estates. Town Clerk, Town Hall (deposit £2 2s.).

Hastings.—November 2nd. Electricity Department. Galvanised steelwork for overhead lines, creosoted red fir poles, stay blocks and single-phase and three-phase, indoor and outdoor transformers for twelve months. (October 14th.)

Herefordshire.—County Council. Electric lighting and power, electric clocks, call bells, fire alarms, emergency lighting and lifts for a proposed new hospital and adaptations at the existing public assistance institution. (October 21st.)

Leyton.—November 10th. Electricity Department. Extra-high-voltage switchgear and reactor equipment. (See this issue.)

Lichfield.—Electricity Department. Street lighting equipment for lighting the Friary. (See this issue.)

London.—HORNSEY.—October 29th. Electricity Department. DC and AC electricity meters, maximum demand indicators, DC and AC fixed charge collectors and time switches. (October 14th.)

BETHNAL GREEN.—November 18th. Electricity Undertaking. One 750-kVA transformer. (See this issue.)

Louth.—November 21st. Electricity Department. P.i. lead-covered, low-voltage cables. (See this issue.)

Manchester.—October 28th. Electricity Committee. AC electric fan motors and three-phase 40/230-V switchgear for twelve months. (October 14th.)

October 31st. Electricity Department. One emergency control board for 6.6-kV switchgear. (October 21st.)

November 11th. Electric water heaters for twelve months. (See this issue.)

Newton-in-Makerfield.—November 11th. Electricity Department. Two 400-kVA transformers and one 11-kV switchboard. (October 21st.)

New Zealand.—WELLINGTON.—January 24th, 1939. Public Works Department. Seven 7,400-kVA single-phase transformers complete with accessories. (T.Y. 27512/38.)*

February 14th, 1939. Supervisory or remote-control equipment, semi-automatic and protective equipment, switchgear and accessories. (T.Y. 27946/38.)* Auxiliary generator and exciter sets, voltage-regulating equipment and accessories. (T.Y. 27947/38.)*

February 14th, 1939. Two 22,200-kVA generators and two 28,000-HP turbines. (T.Y. 27513/38.)*

January 9th, 1939. Post and Telegraphs Department. Two motor-generator sets. (T.Y. 27818/1938.)*

CHRISTCHURCH.—November 10th. Electricity Department. Two voltage regulators. (T. 27502/1938.)*

Peterborough.—November 7th. Town Council. Three sets of Diesel oil engines driving centrifugal pumps, together with appurtenant works, for Wilsthorpe waterworks pumping station. City engineer, Town Hall (deposit £3 3s.).

Rochdale.—November 22nd. Electricity Department. AC 5-A and 25-A quarterly and prepayment meters for twelve months. (See this issue.)

Royton.—November 1st. Installation of electric lighting and power in 118 houses. Surveyor's office, Town Hall.

Seaton Valley.—U.D.C. Electrical installations in 132 houses on the Hester Hill estate. T. W. Burgess, surveyor, Council Offices, Shiremoor.

St. Helens.—November 11th. Electricity Department. High- and low-voltage p.i. cables. Salt glazed stoneware ducts and cable protection tiles. (October 21st.)

South Africa.—PORT ELIZABETH.—November 10th. 22,000-V, 0.15 sq. in., three-core cable and accessories. (T.Y. 27462/38.)*

November 24th. City Municipality. Two miles of low-voltage cables and quantities of 250-V lamps. (T.Y. 28130/38.)*

JOHANNESBURG.—November 12th. City Council. One 750-kW automatic rotary convertor. (T.Y. 27731/38.)*

November 17th. Electricity Department. 20,000-V 0.25 sq. in. three-core screened cable, pilot cable, joints and auxiliary appliances. (T.Y. 28146/1938.)*

CAPE TOWN.—November 2nd. Electricity Department. One 500-kVA three-phase transformer and two three-phase current limiting reactors. (T.Y. 27757/1938.)*

November 24th. Overhead line material. (T. 27775/1938.)* Combine insulated copper wire. (T.Y. 27776/38.)*

October 31st. 110-V, 230-V and 240-V electric lamps. (T. 27773/38.)*

December 14th. Low-voltage pole mounting fuse holders and high-rupturing-capacity fuses. (T.Y. 27985/38.)*

PRETORIA.—December 1st. Union Tender and Supplies Board. 1,000,000 insulated, fibre head, 1in. nails. (T.Y. 27999/38.)*

December 1st. Fifty portable type field telephones. (T. 28002/38.)*

November 24th. Batteries for motor vehicles for twelve months. (T. 28140/38.)*

Southampton.—November 22nd. Electricity Department. One 15-ton electric trolley locomotive for the generating station, Western Esplanade. (October 21st.)

Uruguay.—MONTEVIDEO.—November 17th. Electricity Supply and Telephones Administration. 20,000 metres of twin v.i.r. cable. (T.Y. 27835/1938.)*

November 18th. 400,000 metres of lead-covered cable. (T.Y. 27836/1938.)*

November 21st. 400,000 metres of twin v.i.r. cable. (T.Y. 27837/38.)*

Stafford.—November 3rd. Town Council. Two electrically driven direct-coupled vertical spindle centrifugal multi-stage well and booster pumps, and all other works in connection therewith. Borough engineer, Borough Hall (deposit £5 5s.).

Orders Placed

Bedford.—Electricity Committee. Accepted. Transformers for twelve months.—British Electric Transformer Co.

Birmingham.—Accepted during the period June 10th to September 23rd.

Baths Committee. Electric lighting and power installation at Monument Road Baths.—Rashleigh Phipps & Co.

Public Assistance Committee. Installation of an electric passenger bed lift at Highbury Home.—Keighley Electrical Engineering Co. Electrical installation at Highbury Home.—Springvale Electrical Co.

Electric Supply Committee. 45-A double-pole main switch fuses.—Bill Switchgear. Cable jointing compound for twelve months.—W. H. Keys; B.I. Cables. Meters.—Chamberlain & Hookham; Measurement; Switchgear and Meters; Aron Electricity Meter; Landis & Gyr; British Sangamo Co. Switchgear equipment for Hams Hall power staton.—G. E. C.

Bradford.—Electricity Committee. Recommended. Two 750-kW mercury-arc rectifiers and three traction feeder equipments.—English Electric Co. Distribution lines at Egypt, Harrop Edge, &c.—Transmission Lines & Cables.

Brighton.—Corporation. Accepted. One Diesel-driven alternator for Laughton Lodge Colony.—Crossley Bros.

Cardiff.—Electricity Committee. Accepted. Electric lorry (£367).—W. Lewis & Sons (Cardiff). Two 10,000-kVA transformers (£9,500).—English Electric Co. One 7,500-kVA transformer (£3,800).—B.T.H. One six-panel switchboard (£15,884).—G.E.C. One two-panel switchboard (£5,291).—Met.-Vick. Electrical Co.

Transport Committee. Accepted. Four miles of trolley wire (£358).—British Ropes.

London.—ISLINGTON.—Electricity Committee. Recommended. Switchgear for sub-stations (contract extension for three years).—Electric Construction Co.

SOUTHWARK.—Electricity Committee. Recommended for twelve months. Cables.—Aberdare Cables; Britannic Electric Cable & Construction Co.; Ismay Cables; Scottish Cables.

BATTERSEA.—Electricity Committee. Recommended. Fire protective equipment (£1,784).—Mather & Platt.

ST. MARYLEBONE.—Electricity Committee. Recommended. Meters for twelve months.—Chamberlain & Hookham; Ferranti. Meter-testing equipment (£926).—Met.-Vick. Electrical Co.

Manchester.—Electricity Committee. Recommended. 6,600-V sub-station switchgear for two years.—Ferguson, Pailin. Sub-contractors for instruments and switchgear.—Met.-Vick Elecl. Co. Spare circuit-breakers for Barton and Stuart Street sub-stations.—B.T.H.; Ferguson, Pailin. Emergency control board.—B.T.H.

Middlesbrough.—Town Council. Accepted. Installation of a lift in the Borough Engineer's Department at the Town Hall.—Pickerings.

Stoke-on-Trent.—Electricity Committee. Accepted. Two 15,000-kVA transformers.—Met.-Vick. Electrical Co.

Work in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Houses, Anderson Drive North (124) and Tullos (163), for the Corporation; city architect. Reconstruction of Northern Hotel, Kittybrewster, after fire (£25,000); manager.

Acton.—Factory, Brunel Street; Holman Bros., Ltd., Broad Street House, E.C.2. Factory, Telford Way; Hillier, Parker, May & Rowden, 27, Maddox Street, W.1. Flats (120), The Vale; Alister MacDonald, 14, John Street, W.C.2.

Bellshill (LANARKSHIRE).—Three public halls; clerk, Bellshill and District Council.

Birkenhead.—Sports stadium (£25,000), for a London syndicate; R. Satchwell, architect, 6, New Street, Birmingham.

Birmingham.—Factory and offices, Cheapside; W. C. Skinner, Ltd., builders, 316, Birchfield Road, Birmingham.

Blackpool.—Houses (50), St. George's Avenue, Whiston; R. & H. Fletcher, Ltd., builders, Cleveley's, Blackpool.

Bournemouth.—Hotel, Exeter Road; N. Ridout. Shops and houses, Muscliff Farm estate; A. J. Abbott & Son. Alterations and additions to Palladium Cinema, Seaborne Road; Grahame Gibbs.

Bradford.—Enlargement of St. Patrick's R.C. school (£15,880); S. Simpson, architect.

Broadstairs.—Houses, Old Green Road, for the U.D.C.

Burslem.—Houses (12), near Leek New Road; Mr. Minshull.

Bury.—Houses (60), Rochdale Old Road; W. E. Yates & Son, builders, 47, Thorn Road, Bolton.

Cardiff.—Air port buildings; city engineer. Hall and sports arena (£347,515) and car park (£93,100); Sunley, Ltd.

Carlisle.—Police and fire station for the City Council (£53,000); J. Laing and Sons, builders.

Consett.—Houses (60), Medomsley; U.D.C. surveyor.

Coventry.—Houses (111), Abbey Road, Ashington Grove and Rutherglen Avenue; A. Rosier, 9, Beechwood Avenue. Houses (23), Brayford Avenue; A. H. Coltman & Son, 143, Barker Butts Lane. Houses, Brownshill Green Road and Kelmscote Road; A. Ward, Lythalls Lane. Houses, Court Leet Road and Frankpledge Road; Merrett & Co., 12, Bede Road. Houses (28), Dunchurch Highway, at the corner of Broad Lane; Hobley Bros., Ltd., 71, Crosbie Road. Houses (32), Herrick Road; Bold Building Co., Ltd., 96, Lower Ford Street. Houses (74), Kenpas Highway and Salisbury Avenue; Browning Bros., St. Oswald's estate, Lowford Road, Rugby. Houses (24), Owenford Road; A. Jervis, builder, Holyhead Road. Houses (24), St. Ives Road; Bratby & Sons, 44, Mellowdew Road, Wyken. Houses (20), Swinburne Avenue; Breeze & Burdett, 4, Stevenson Road. Houses (19), Treherne Road and Rollason Road; J. G. Perks, 101, Moor Street.

Cranbrook.—Houses (28), High Street, for A. Glock.

Dundee.—Cinema, Arbroath Road; J. B. Milne, cinema proprietor, Palladium.

East Ham.—Central garage (£11,400); borough engineer.

East Lothian.—Fourteen classrooms, hall, etc., Cockenzie public school (£40,000); F. W. Hardie, county architect, Haddington.

Eire (DUBLIN).—Extensions to factory, for Irish Button Co., Ltd., Drumcondra Road.

Glasgow.—Hotel, Union Street (£75,000); Montague Burton, Ltd.

Gorleston-on-Sea.—Block of flats, Marine Parade; F. M. Dewing.

Great Yarmouth.—Extensions to factory, Salmon Road; F. C. Miller, Ltd. Rebuilding of factory, Estcourt Road; D. Yaxley,

Grimsby.—Extensions to South Parade school (£21,722); Wilkinson & Houghton, Ltd.

Guildford.—Houses (118); R.D.C. surveyor.

Hertfordshire.—Schools, Sundridge Lane, St. Albans (£26,986), King's Langley (£40,713), and enlargement of London Colney school (£20,645), for the County E.C., County Offices, Hertford.

Hythe (KENT).—Houses (20), Horn Street, and block of six flats, Hythe Green, for the Town Council.

Kidlington.—Cinema for E. A. Huddleston, Witney.

Liverpool.—Houses (36), Manvers Road, for J. Williams, 37, Island Road, Garston; Richard Owens & Son, architects, 11, Westminster Chambers, Liverpool. Factory, Fazackerley, for Bradleys (Chester), Ltd. Laboratory buildings, Brownlow Hill, for the University of Liverpool; H. E. Davies & Son, architects, Wellington Buildings.

London.—(E.C.3).—Buildings, Bury Court; Sir John Burnet, Tait & Lorne, Montague Place, W.C.1. (SOUTHWARK).—Factory, Bittern Street; Lansdown & Devereux, 6, Grosvenor Street, W.1. Rebuilding of Royal Eye Hospital, St. George's Circus; Young & Hall, 17, Southampton Street, W.C.1.

Lowestoft.—Houses (24), Mount Pleasant; Warnes & Son.

Luton.—Houses, Stopsley and Leagrove estates; borough engineer.

Manchester.—Houses, Dean Lane, Jackson Street and Ramsey Street, Moston, for Westcliffe Investment Co., Ltd.; J. R. Gradwell, architect, 17, St. Anns Square, Manchester. Houses, Heaton Park Road, Parkway, Southwood Drive, Westway, Branksome Drive and Wyville Drive, Blackley, for Lanes Construction (Manchester), Ltd., 1, Dickinson Street; A. Bennett & Son, architects, Dales Brow, Swinton. Houses, Parkleigh Drive, Walmersley Road and Kenwick Drive, New Moston; J. Saxon, builder, Victoria Avenue. Houses, Ramsey Street, Moston, for F. Entwistle, Kingsway, Davyhulme, Urmston; Sharp and Cowburn, architects, 40, South King Street. Houses, Rectory Road, West Avenue and Wentworth Avenue, Gorton, for Howard & Clarke, Bute Street, Peacock Street, Manchester, 18; P. G. Kelvey, architect, 379, Moss Lane East. Houses, Victoria Crescent, Stanwick Avenue, Alderley Avenue and Draycott Road, Blackley; Winter Bros. (Builders), Ltd., Victoria Avenue, Blackley. Offices, at the corner of Mosley Street and Charlotte Street, for Ellis & Son, 1, Princess Street; Anns and Haigh, architects, 58, Grosvenor Street, London, W.1.

Newcastle (STAFFORDSHIRE).—Premises for J. Hammond & Co. (1922), Ltd., Enderley Mills; Hollins & Jones, architects, Lloyds Bank Chambers.

Newcastle-on-Tyne.—Houses (74), Benton Road; Hadden and Hillman, builders, Huddleston Road, Heaton. Houses (14); R. W. Fullerton, builder, 33, Beatrice Road. Factory and offices, Benfield Road; C. S. Errington, architect, 21, Grainger Street, Newcastle-on-Tyne. Offices, Walker Road, for Angus and Co.; Stanley Miller, Ltd., builders, 17, North Street. Schools, Blakelaw estate and Cragside, for the E.C.; director of education, Northumberland Road.

Newport Pagnell.—Houses (28), Broad Street, for the U.D.C.

Northampton.—Extensive garage premises, showrooms, service depot, offices, café, &c., Bridge Street, Victoria Promenade and Cattle Market Road, for Arthur Mulliner, Ltd., Bridge Street. Headquarters, Clare Street, for the Territorial Army Association (£20,000); Underwood and Weston, Lady's Lane.

Paignton.—Houses (280), Marldon Road; F. J. Furse.

Penkhull (STAFFORDSHIRE).—Land development near Queen's Road; C. J. Richards, architect.

Perthshire.—School, Viewlands, Perth (£38,500), for the County Council; architect, Education Office, York Place, Perth.

Portsmouth.—Sports stadium (£25,000), for a London syndicate; R. Satchwell, architect, 6, New Street, Birmingham.

Ryhope.—Drill hall; W. and T. R. Milburn, architects, 17, Fawcett Street, Sunderland.

Sheffield.—Houses (300), Norton estate; Gleeson, Ltd., builders, Chesterfield Road.

Shifnal.—Houses (87), Albrighton estate; R.D.C. surveyor.

Shirley (WARWICKSHIRE).—Sports stadium, cafés and ice-rink, Stratford Road; R. Satchwell, architect, 6, New Street, Birmingham.

Smethwick.—Offices and stores, Soho Street; C. Walsh Graham, Ltd.

Stockton-on-Tees.—Houses, Newlands Avenue; A. E. Hobbs, builder, Hill House, Norton. Extensions to St. Bede's R.C. school; A. Harrison, architect, 69, High Street.

Stoke-on-Trent.—Houses (36), Whieldon Road, Fenton; A. Bates. Houses (30), Willow Drive, Blurton; F. C. Gibson. School, Boothen Old Road, for the E.C.

Sunderland.—School, Villiers Street (£57,476), for the E.C.

Swansea.—Houses (411), Manselton estate; Manselton Estate Co. Shops and offices, Waterloo Street; Estateways Builders, Ltd. School, Sketty (£17,940); borough architect.

Todmorden.—Houses (56), Heptonstall estate; R.D.C. surveyor.

Tunstall.—Houses (10), Mellor Street; H. Burton. Houses (76), Turnhurst Road; C. Sutton.

Wallsend-on-Tyne.—Schools (£131,000); P. L. Browne, Son, and Harding, architects, Pearl Buildings, Newcastle-on-Tyne.

Wednesbury.—Houses, Park Hill, Oak Tree Road and Woden Road East; E. Smith & Son, Moorlands Farm estate, Stone Cross.

Whitley Bay.—Cinema, for the Capitol Cinema Co.; Thomas Clements and Son, builders, Selborne Gardens, Newcastle-on Tyne.

Willington (Co. DURHAM).—School; F. Willey, 34, Old Elvet, Durham City.

Wombwell.—Houses (18), Wilson Street; Hey and Murfin, Summer Lane.

Worcester.—Police and fire brigade headquarters (£79,000); borough engineer.

Yorkshire.—School, Altofts, for the West Riding E.C.; E. Maxwell Fry, architect, 171, Victoria Street, London, S.W.1. School, Sheffield, for the West Riding E.C.; Hadfield & Cawkwell, architects, 19, St. James Street, Sheffield.

Sulphur Extraction Plant at Fulham

As a result of the experience gained during the working of the sulphur extraction plant at the Fulham power station it was decided last year, on the advice of the consulting engineers, to install centrifugal instead of axial flow pumps on certain boilers. The borough electrical engineer has now reported that he is completely satisfied that the whole of the axial flow pumps should be replaced by centrifugal pumps, and he has submitted particulars of the cost of maintenance of the two kinds of pumps which show an estimated annual saving in maintenance costs of £4,130, if his proposal is adopted. The estimated cost of replacing the existing axial flow pumps with centrifugal pumps is £8,000.